ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

Vol. LXIV. No. 24. CHICAGO, SATURDAY, JUNE 13, 1914. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET
CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada.....4.00
One Year, Foreign Countries.....6.00
Single Copy, 10 cents. Back one month, each..25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879

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THE VALUE OF CORDIAL RELATIONS BETWEEN PUBLIC UTILITIES AND THE PUBLIC.

It is not so many years ago since the attitude of the managers of railroad systems and other utility properties toward the public was exactly the same as that of the greedy business man, now happily almost out of date, who wants to get all he can from the public and give as little as possible in return. These men felt that they were in the utility business by divine right and that if the public wished their service it could have it at rates which they thought proper; but that the public should have any remote right to be concerned in the conduct of the business or in the determination of the rates or nature of the service was absolutely beyond comprehension. The result of this attitude is the hostile feeling of the public toward nearly all utility companies, still prevalent in so many parts of the country.

It is pleasing to note that in the same state where the famous saying "The public be damned" originated, there was made a few weeks ago an address showing the modern attitude of utilities toward the public. We refer to the extemporaneous but splendid address made by Mr. R. M. Searle before the recent convention of the National District Heating Association, a brief abstract of which is given on another page of this issue. Mr. Searle is one of those thoroughly wide-awake managers of a large utility system who realize that the public will not treat a utility company unfairly if it is given fair treatment in turn. He believes in maintaining at all hazards the most friendly relations with the public, and has some excellent ideas as to how this may readily be done. For one thing he believes in letting the public know about the details of the business which affect the rates charged or the quality of the service. He believes that the patrons of a utility should always have the liberty to bring in complaints directly to the attention of the management. Such complaints, many of which are constructive, should receive immediate attention. If this is given, the cause for more serious disputes between the utility and the public is nearly always removed.

Mr. Searle has another excellent idea in that he does not believe in the old-time one-man idea of a large concern. In such an establishment, if everything must be referred to the head of the company,

who of course has human limitations, many things are tied up indefinitely or receive improper consideration. A true manager will use such care in the selection of his heads of departments and his entire staff that he may repose complete confidence in them and let each man take responsibility upon himself.

Still another excellent thought Mr. Searle brought out in the address was that employees should be permitted to speak to newspaper representatives so long as they state the absolute truth. This is a feature that is highly desirable in many organizations where it is not now in evidence. In many such concerns a person desiring some information, which he is quite sure is not confidential, cannot obtain it without being referred from one person to another, until finally he is likely to lose patience and give up the attempt. Of course, with many of the aggressive newspaper representatives, this policy does not prevent them from publishing things about the company, even though they may not be obtained from reliable sources; frequently gross misstatements are made in the public press because persons who have been approached, and who had the information that was desired, were reluctant to give it out without the sanction of some superior officer.

Throughout Mr. Searle's address there can be noted a fine spirit of open and frank dealing, absolutely above board, which in the case of his company has resulted in the most cordial relations between the utility and the public. Not only does this practically eliminate the needless bickerings that are still manifested in many communities when utility matters come up for consideration, but it has raised the Rochester utility so much in the esteem of its public that the securities of the company are being freely purchased by its own customers and other local people. This alone has been a most highly desirable feature, because if many citizens in a community have a direct financial interest in the utility company which serves them, it is bound to promote that stability of friendly relations between the utility and the public which is to the mutual benefit of each. If more of our cities could boast of the good will of the Rochester company there would be very much less agitation for municipal ownership and drastic government regulation.

THE PITTSFIELD MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The Pittsfield meeting of the American Institute of Electrical Engineers, reported in this issue, was devoted principally to a discussion of the relative merits of delta and star connections for transformers. The discussion of this question makes it evident that there are a number of points connected therewith upon which there is no unanimity of opinion. Some of the speakers contended that there are important differences between ungrounded star and delta connections; whereas others maintained that the only important differences arose when the neutral of the star connection is grounded. There were contenders also for the superiority of both the isolated-delta and the grounded-star systems, especially when disturbances to telephone lines are taken into consideration. The trend of practice in this country upon high-voltage lines seems to be toward the use of the grounded-star system of connections and unquestionably this system has certain advantages under certain conditions. The only question seems to be whether there may be conditions under which these advantages disappear and where the isolated delta or isolated star is to be preferred. Regarding this point also there seems to be some difference of opinion. While the practice in Italy favors the ungrounded delta system, this appears to be mainly due to the fact that it was first used and has not developed enough serious trouble to lead to its abandonment.

It was hoped that this meeting would bring out sufficient evidence, with discussion from different standpoints, to make it possible to arrive at a definite answer to the problem, and although Mr. P. H. Thomas was on the ground to sum up the considerations brought out in the discussion, it can hardly be said that this point was accomplished. Certainly those who participated in the discussion did not come to any common ground in their attitude toward this question. The reader may, however, be better able from a consideration of all of the arguments brought out, to form a definite opinion upon the subject.

WHAT IS DISCRIMINATION?

A recent case before the Public Service Commission of the Commonwealth of Pennsylvania, in which a customer of the Bethlehem City Water Company complained of discrimination, brings up a point of much interest to all utility companies. The public utility law in most states provides that there shall be no discrimination shown in rates to customers receiving service under substantially similar conditions. The Pennsylvania Act of 1913, which established the Commission, provided that no greater or less compensation should be exacted from one customer than from any other "for a like and contemporaneous service under substantially similar circumstances and conditions."

In the case in question, the utility company had offered a special discount to consumers of water residing along streets where city water mains exist, the only reason for the distinction being the competition in supply to the latter class. The Commission decided that such competition constitued a difference in the conditions of service which warranted the discrimination in rates.

This decision sets a new precedent as to what constitutes discrimination and furnishes an interpretation of the law which was probably never intended

by its framers. Heretofore "similar conditions of service" has been regarded as referring to the physical conditions involved, such as the quantity consumed, time at which consumed, etc. If business considerations alone furnish a sufficient warrant for discrimination, it is probable that any discrimination in rates whatever might be justified.

The Pennsylvania Commission in this case, however, has had in mind the best interests of the utility company which was made the respondent in this case, and has made the best of a difficult situation. The case arises on account of conditions which are not recognized in the theory which is at the basis of public-utility control. Where a utility company has a monopoly in the supply of its product in a particular territory, the conditions represented in West Bethlehem could not come about, and the law is framed in disregard of such a condition. The difficulty resides in the possibility of a municipality erecting a competing plant where a utility company is already furnishing service. The proper solution of the question is the prevention of such conditions by placing municipally owned and operated utilities under the same conditions that apply to privately organized utility companies, and in protecting established utilities from competition.

LANGLEY'S FLYING MACHINE.

Newspaper dispatches of May 28 stated that a successful flight had been made at Hammondsport, N. Y., by the well known aviator, Mr. Glenn Curtis, in the machine constructed by Langley in 1906.

It will be remembered by anyone interested in the subject of aviation that Secretary Samuel P. Langley, of the Smithsonian Institution, received a grant of funds from Congress for the purpose of carrying out his ideas in the construction of a machine heavier than air which would be capable of sustained flight. The machine was constructed, transported down the Potomac River, and the attempt at flight made by projecting the machine into the air over the river from its starting platform. Owing to an accident in starting, the machine did not acquire stability, but fell into the river and was damaged. Funds were not available for repairing the machine and making another trial, and Professor Langley was compelled to endure the disappointment of having his experiment regarded as a failure and being subjected to much ridicule.

After an interval of eight years, during which the death of the noted scientist has taken place, it has been demonstrated that his machine was constructed upon correct principles and was capable of sustaining itself in the air when given a proper start. While this vindicates the principles upon which Langley worked and is a consolation to the friends who had faith in his ability, it can never wipe out the disappointment which was his, due to his failure to continue the demonstration himself to the point of success. It will, nevertheless, help to establish his name as one of the pioneers who developed the subject of aviation and constructed a machine which was capable of flying through an atmosphere lighter than itself. It helps to demonstrate also that the proper application of scientific and mechanical principles to any problem will eventually achieve the recognition which is its due.

This incident presents the opportunity to emphasize once again the many directions in which the applications of electricity have benefited mankind and made possible achievements which could not otherwise be attained. Development of the aeroplane was dependent upon the application of the explosion engine, and this in its turn is wholly dependent for the ignition of its charge upon an electrical spark. It is well to bear in mind, consequently, in considering the wide application of electrical energy, that aviation and all other applications of the gasoline engine owe their achievements to an electrical method of controlling the energy upon which their success depends.

ELECTRIFY THE WEDDING GIFT.

The ancient worship of Juno, the goddess of matrimony, has left its traces to this day in the designation of June as the favorite month of brides and grooms. Thus June is the month of peak load for marriage-license clerks and ministers, as well as for the purveyors of things appropriate for wedding gifts.

Nearly every bride has a strong penchant for having everything connected with her wedding as attractive as possible and thoroughly up-to-date. This is natural because marriage is the climax of optimism, just as it is supposed to be the acme of happiness. It has been found that there is scarcely any line of wedding gifts that pleases a modern bride as much as an array of things electrical. They satisfy her desire to be right "up to the minute"; they are invariably attractive; they are always useful; they are the personification of convenience, and they conduce to the true happiness of the bride by making her realize that hers is not to be a life of drudgery and toil, but one in which leisure time will be left for culture and the higher things of life.

That June is a psychological time for pushing the sale of electrical appliances and utensils is being appreciated by a number of manufacturers and dealers in such devices. In this issue will be found a note of how the wide-awake management of the Louisville central-station company is actively carrying on a campaign of this nature through newspaper publicity and a special display.

Such a campaign carried on at this time should bring valuable returns. Electrical gifts at Christmas have become extremely popular and have furnished excellent revenue for electrical manufacturers, dealers and central stations. Just at this time, with the hot weather upon us, electrical cooking devices, fans and all other electrical appliances that will reduce the discomforts of the torrid season, make a peculiar appeal to the prospective as well as the mature housewife. Therefore, let us electrify the wedding gift.

Meeting of Chicago Jovian League.

Major Carl F. Hartman, chief signal officer, Central Department of the United States Signal Corps, was the speaker at the luncheon of the Chicago Jovian League on June 8. Major Hartman spoke on "Electricity in the Army in Time of War or Peace." Much of the work of the Signal Corps during times of peace is devoted to the establishment of advanced posts, such as those in Alaska. In this territory the government has erected over 36,000 miles of land lines for telegraphing and telephoning. Radio stations, however, are rapidly replacing these land lines as it is found that they are more satisfactory for that climate in all ways. The Panama Canal, he said, also was a large undertaking for the government in the way of electrical equipment, a complete 5,000-horsepower hydroelectric plant having been built. Considering the subject of harbor defense, he called attention to the fact that the large guns are fired without the gunners seeing the target, several observation points sending data to a plotting room from where the correct setting of the gun is telephoned to the gunners. During war, he said, telephone lines, buzzer lines, telegraph lines, and radio stations advance with the army. Some idea of the quickness with which this work is done, can be obtained from the fact that it requires only two minutes to unload a portable radio set and to place it in operation.

In the absence of President Homer E. Niesz, Vice-President F. W. Harvey, Jr., occupied the chair and Thomas G. Grier introduced the speaker. A large number of members of the Chicago Electric Club were present at the meeting by special invitation.

Lansing Jovians Have Rejuvenation.

A very successful meeting of Michigan Jovians was held in Lansing, Mich., recently, when 52 members gathered at the Hotel Wentworth. Members of the Lansing Jovian League, together with other Jovians from nearby cities, took part in the festivities, which included a banquet with several addresses; 13 candidates were initiated into the Order. This was the second rejuvenation held by the Lansing League, which now has 40 members.

Youngstown Jovians Working for Club Rooms.

Youngstown, O., Jovians and their friends gathered in force on a recent evening at the Park Theater, filling the house to overflowing. The attraction was not so much the excellence of the performance, although it was very good, but the fact that the Jovians had bought out the house for the evening and resold it, as a part of their campaign for funds with which to equip new club rooms. The fund is growing rapidly, and with the profits gained by the theater "stunt," and with other projects under way by which substantial sums are hoped for, indications are that very shortly there will be available a sufficient amount to furnish the organization's rooms in luxurious style.

Valuation of Cincinnati Utility Under Way.

The Union Gas & Electric Company, of Cincinnati, O., is actively at work on an inventory of its properties, which was requested some time ago by the Ohio Public Utilities Commission, and expects to have it completed well within the time limit set, which is October 1. At the same time, the City Council of Cincinnati has completed arrangements to have a physical valuation of the company's properties made under the supervision of A. C. King, deputy commissioner of electricity and gas, of Chicago, for the purpose of affording a basis for charges for current. There has been considerable criticism of the action of the Council, opponents of the plan pointing out that the methods used by the company for the Utilities Commission and those to be used by Mr. King on behalf of the city are said to be practically identical, and that the city, therefore, could have saved the expense, for which $8,000 has been appropriated, by awaiting the result of the company's inventory.

Placing of Wires Underground Deferred at Newport, Ky.

Protesting against the proposed action of the city commissioners of Newport, Ky., who are contemplating an ordinance by which public service corporations using overhead wires will be compelled to place them underground, Secretary Albert Silva of the Union Light, Heat & Power Company appeared before the commissioners last week on behalf of that company and set forth reasons why the company believes this action should not be taken. He said that the company has made very low rates, not only for street lighting, but for domestic consumers as well, on the understanding that the system now in use could be continued, and that the large expenditure necessary to place its wires underground would necessarily mean a readjustment of the rates, and, therefore, a hardship on the consumers and the city. The commissioners have taken the matter under advisement and no action will be taken for the present.

Exports of copper for the week ended June 4, totalled 8,690 tons, compared with 7,049 tons during the corresponding week last year.

Electric Club of Chicago Hears About Mexico.

A well attended luncheon meeting of the Electric Club of Chicago was held at the Hotel Sherman, Chicago, on June 4, with Vice-President W. C. Berry presiding. Announcement was made that as usual the weekly meetings will be discontinued for the summer after the June 18 luncheon, which will be a special get-together meeting and entertainment; weekly meetings will again be resumed on September 17. The invitation of the Chicago Jovian League to join its meeting of June 8 was unanimously accepted.

Mexico was the subject of the address by the speaker of the day, Robert J. Kerr, a Chicago lawyer who has made many trips to Mexico and who was civil governor of Vera Cruz in the interim between its recent seizure by our Navy and its occupation by the Army. He referred to the hydroelectric and other electrical developments in that country as worthy of arousing the interest of electrical men in its now unhappy condition.

Mr. Kerr touched on the characteristics of the Mexican people, pointing out that the extreme illiteracy (85 per cent of the inhabitants cannot read or write), as well as the slow development of the great mass of the Indian population, retarded the progress of the country and rendered its government on democratic lines well nigh impossible. He briefly traced the history of the nation, dwelling particularly on the upheavals of the last four years. Incidents were cited to show the gross ignorance of the average Mexican soldier and his contempt for the rules of modern warfare. Taking up recent developments at Vera Cruz, Mr. Kerr eulogized the behavior of the American troops and contrasted it with the conduct of their treacherous opponents.

Some features of our Government's Mexican policy were severely criticized by the speaker. The failure to secure protection for American citizens in Mexico was denounced, as was the advice that they leave their possessions, in most cases all they had, and depart from the country. The difficulties attendant on this were pathetically retold. The great bulk of American investments in Mexico were made not by powerful capitalists or trusts, said Mr. Kerr, but by people of moderate means, who were trying in a legitimate way to bring the blessings of civilization to a backward country by developing it and not by exploiting it. On account of proximity American manufacturers have a marked advantage in supplying Mexican wants and they should be encouraged, if our Government is really anxious to promote foreign trade.

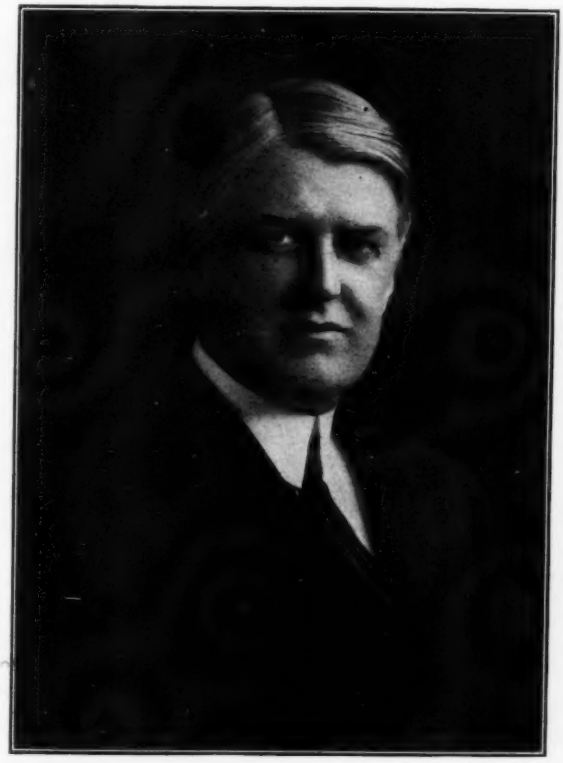
Morgan Brooks.

Morgan Brooks, practical electrician, inventor, engineer, scholar and instructor, has accomplished much for the electrical industry and contributed greatly to our modern conception of technical education and training of engineering students.

Morgan Brooks was born in Boston, the youngest son of Francis A. Brooks, a lawyer of marked individuality and personal force. Prepared at the famous Roxbury Latin School, he entered Brown University in 1877 with honors in mathematics. He was the youngest in his class until the advent in sophomore year of the now distinguished Justice Charles E. Hughes. Graduating from Brown in the scientific course and desiring further engineering training, he spent the two succeeding years at Stevens Institute of Technology and received the degree of Mechanical Engineer in 1883. His graduating thesis in collaboration with his classmate, J. E. Steward, upon "Tests of a 10-Horsepower Otto Gas Engine," was published in *Van Nostrand's Magazine*, and translated into French and German, owing to the tests covering the metering of the air as well as the gas consumed. Knowledge thus gained secured Mr. Brooks his first engineering position, with the Boston agents of the Otto engine. The following year he went into experimental work for the American Bell Telephone Company, establishing the first copper-wire specifications for that company, and testing telephonic inventions offered for purchase. In 1886 he followed Theodore N. Vail from the telephone to the storage-battery field, accepting a position with the Electrical Accumulator Company of Philadelphia in its Boston office. His work was the preparation of plans and specifications and the installing of storage batteries. It also included one of the earliest experiments in car lighting in America, that of the Fall River Boat train of the Old Colony Railroad, operating successfully in the winter of 1886-1887.

In 1887, on behalf of the St. Paul Gas Light Company, he investigated the then new transformer method of alternating-current lighting with 50-volt lamps promoted by the Westinghouse Electric & Manufacturing Company, and introduced it the following year at St. Paul in competition with the Edison three-wire direct system. Three years later he organized the Electrical Engineering Company of St. Paul-Minneapolis as contractors for the installing of light, power and telephone plants. The company grew into the foremost wholesale electrical supply house operating exclusively in the Northwest. During this period Mr. Brooks patented an intercommunicating telephone system for upwards of 100 subscribers, which was introduced at Northfield, Minn., and invented a successful device for eliminating "side-tone" in telephony.

In the summer of 1898 the chair of electrical engineering at the University of Nebraska was offered to him and accepted. He was for three years engaged in building up that department before accepting a similar call to the University of Illinois, where he is still teaching. At that time the number of students in electrical engineering was small, graduating classes numbering from 6 to 10 the first three years. Since then the growth has been rapid, graduates of 1909 exceeding 50. This increase Professor Brooks ascribes to the growing importance of electrical engineering, but those acquainted with his work think that his improvements in the course of study, his reputation as a teacher and the success of his graduates had much to do with the advance of his department. Professor Brooks feels that his engineering and business experience have been of great value to him in training students to meet the practical as well as theoretical demands of their work.



Morgan Brooks,
Professor of Electrical Engineering at the University of Illinois.

At Illinois, assisted by a graduate student, M. K. Akers, now professor of applied electricity at the State College of Washington, he developed the art of self-synchronizing of alternators. This required the use of reactances without iron cores, a type that has since been adopted generally in the protection of alternating apparatus. Study of inductances led also to the development of the first universal formula for the quick calculation of the inductance of coreless coils of any shape, published in a bulletin of the Engineering Experiment Station of the University of Illinois.

Professor Brooks has served as director and also as vice-president of the American Institute of Electrical Engineers, of which he is a life fellow. Several papers by him have been published in the *Transactions*. His most recent investigations have been in illumination, with particular reference to the lighting problem of large interiors and street lighting for small communities.

Moving Chicago Telephones.

Twenty-five thousand changes of telephone stations with practically no complaints and no demoralization of the service is the unparalleled record of the Chicago Telephone Company for the week ending May 2. It is four times greater than that of any previous year.

This record number of changes is but a part of the thousands made during the Chicago May-moving season. It is a striking evidence of preparedness-to-serve on the part of the Telephone Company to be able to meet the unusual demands upon it at the time when a large part of Chicago's population is indulging in its annual custom of migrating from place to place.

Owing to this custom, public-service companies are obliged to prepare for it weeks in advance. The Chicago Telephone Company, in addition to thoroughly organizing its forces to handle the business, endeavored to impress upon the people the importance of giving early notice where changes of residence were in contemplation. It did this through display advertisements in

the daily newspapers and the periodicals. The company's success in dealing with the problem was due not only to thorough organization and persistent advertising campaigns, but also to the co-operation on the part of the subscribers.

Illuminating Engineering Society Officers Elected.

The report of the Committee of Tellers of the Illuminating Engineering Society on the results of the recent annual election, presented to the Council of the Society on June 11, showed that the following national officers had been elected for the ensuing year: president, A. S. McAllister; vice-presidents for two years, F. A. Vaughn and C. A. B. Halvorson, Jr.; general secretary, Joseph D. Israel; treasurer, L. B. Marks; directors for three years, Ellice M. Alger, Harold Calvert, V. R. Lansingh.

Election of Section officers resulted as follows:

Chicago Section: chairman, W. A. Durgin; secretary, H. B. Wheeler; managers, Harry S. Gradle, M. G. Lloyd, F. A. Pinckney, Edward G. Pratt and Herman V. Willman.

New York Section; chairman, Norman Macbeth; secretary, Clarence L. Law; managers, George W. Cassidy, Norman D. Macdonald, H. B. McLean, Frank E. Wallis and Percy S. Young.

New England Section: chairman, Louis Bell; secretary, S. C. Rogers; managers, C. M. Coles, J. W. Cowles, Walter B. Lancaster, H. F. Wallace, R. C. Ware.

Pittsburgh Section: chairman, G. W. Roosa; secretary, S. G. Hibben; managers, W. A. Donkin, H. S. Hower, Harold Kirschberg, E. B. Rowe and R. H. Skinner.

Philadelphia Section: chairman, H. A. Hornor; secretary, L. B. Eichengreen; managers, James Barnes, Douglass Burnett, George S. Crampton, R. B. Ely and F. H. Gilpin.

The next annual convention will be held in Cleveland, O., during the week beginning September 20.

A German inventor, Johannes Marschall, of Dresden, has recently patented an application of the well known principle of the thermopile to the practical production of electric light without the intervention of boiler, engine, or dynamo. The present invention consists of a furnace containing a series of thermopiles made of heat-resisting metals, and is said to deliver a practical lighting current for a somewhat less fuel cost than the best steam engines. The first cost of the plant should be very considerably less according to the claims of the inventor.

Electrical Decoration for Louisville Saengerfest.

Elaborate preparations are being made in the way of electrical illumination of the streets and public buildings of Louisville, Ky., for the meeting there June 24 to 27, inclusive, of the thirty-fourth Saengerfest of the North American Saengerbund, which is expected to bring thousands of visitors to the city. The contract for the street decoration and the decoration of the public buildings has just been let to the Rueff-Griffin Decorating Company, a Louisville concern.

The company will arrange the illumination as well as hang the bunting over some forty squares in the central part of the city. Its plans, submitted with its bid to the local committee on arrangements, are rather ambitious and will exceed anything ever undertaken previously in Louisville. A total of 18,000 incandescent lamps will be used, some fifteen miles of insulated wire and an indeterminable amount of bunting. The lights will display the colors of the Saengerbund, blue and white, while in addition the red, white and black of Germany will be displayed in textile decorations.

The lyre, emblem of the Saengerbund will appear, of wood and plaster construction and studded with white lights, at every street intersection, where it will be used in connection with the festoons that will be employed at each corner. The lyre will be made use of wherever opportunity offers and will be the only device.

It is estimated by J. T. Griffin that the work of putting up the illuminations will require a force of fifty men, the equivalent of three weeks of steady work. This work will consist for the most part in stringing the wires and connecting the receptacles and lamps, which the company carries in stock to a large extent, and setting up the wood and composition pillars which will be extensively employed on the downtown streets. Each of these pillars will be outlined by incandescent lights while the lyre that will top each will also be studded with lights.

Of the wire to be used in the festoons, some six miles will be in the way of feeder wires for the festoons, on the latter of which the white and the blue lights will alternate eighteen inches apart. Each street intersection will be marked by festoons draped from pillars at each corner to the center.

The lighting decorations will center at the Jefferson County Court House, an ancient structure of the Doric type. In front of this will be the "Court of Honor," an elaborate bit of work in which numerous festoons will be used, together with numbers of pillars and the architectural background, brilliantly lighted and composed of wood and plaster with the light-studded lyres everywhere in evidence. The pillars, to be defined by lights, stand nineteen feet high on bases five feet square, the whole surmounted with the lighted lyres. The platform for the guests of honor and the reviewing stand will be built around the base of the statue of Thomas Jefferson which stands in front of the Court House.

The other public buildings, the City Hall among them, and the Armory, where the principal sessions of the Saengerbund will be held, will get their share of the decorations. Altogether 4,000 lights will be used on the decorations of the public buildings, with another 4,000 in the "Court of Honor."

Many business houses have prepared for special lighting effects. Some of them, the *Courier-Journal* Building particularly, are equipped with permanent wiring for such occasions, when nothing is needed but the attaching of the lights and the turning on of the current. The *Anzeiger*, the German daily in Louisville, is also preparing something special in the way of electrical illumination.

Production of Asbestos in the United States.

A report by J. S. Diller, of the United States Geological Survey, on the production of asbestos in 1913, now in press, shows that while the United States produces little raw asbestos, it is the largest producer of objects manufactured from asbestos. Canada is the heaviest producer of raw asbestos, and more than half the world's supply is brought into the United States from Canada and manufactured into various commercial products.

In 1913 the United States produced 1,100 short tons. There were two producers in Georgia, both furnishing asbestos of the amphibole type, and one in Arizona is just beginning to produce chrysotile.

A notable event of the year in the asbestos industry of the United States has been the opening of this new locality in Arizona, about 30 miles northeast of Globe, for the high-grade chrysotile such as occurs in the depths of the Grand Canyon. In occurrence, origin, quality, and quantity this deposit is essentially the same as that of the Grand Canyon district, but it is much more accessible, being in a canyon about 800 feet deep and within 30 miles by trail and wagon road from the railway. It is associated with limestone and in this respect is strongly contrasted with the asbestos of Canada which is found in serpentine rock, derived from peridotite.

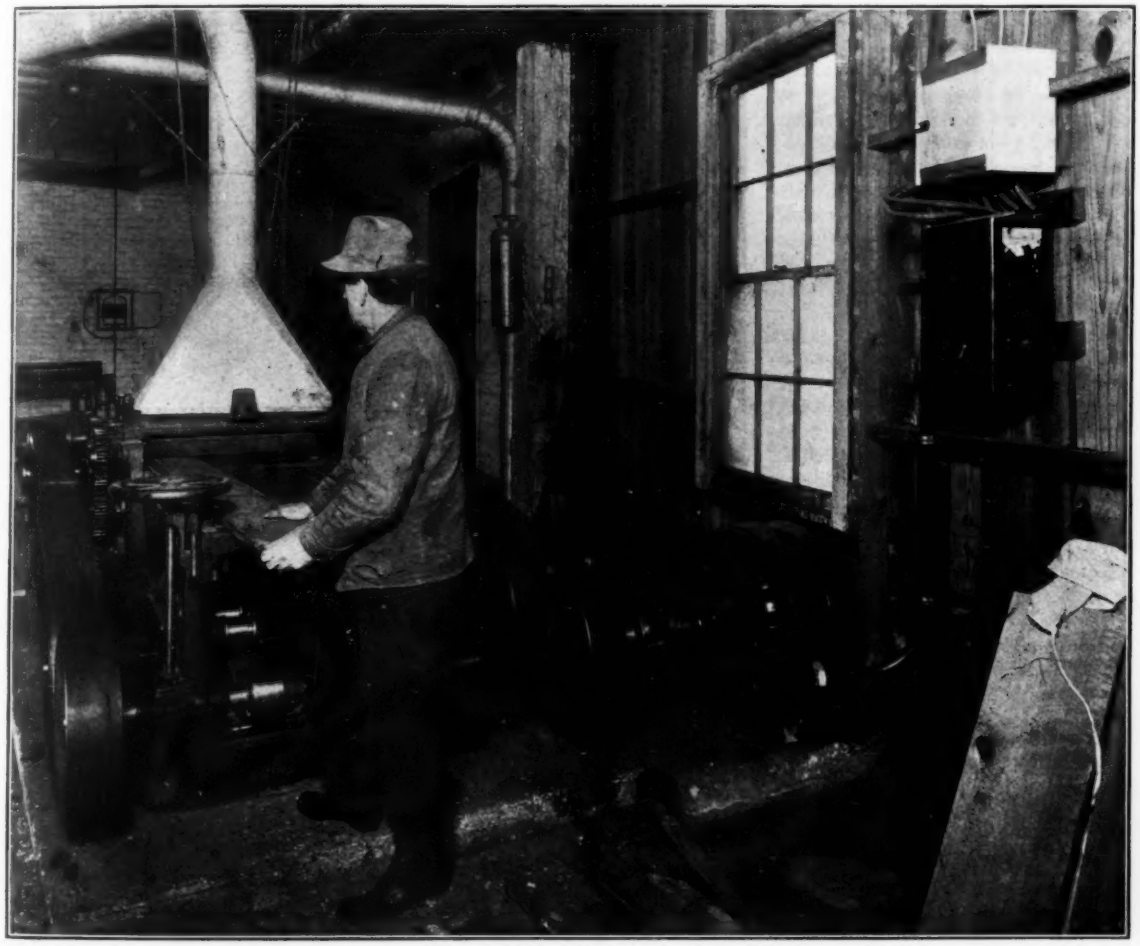
The remarkable fiber from Arizona when twisted to a yarn 0.03 of an inch in thickness will support an average weight of 15.5 pounds. Its content of iron is decidedly lower than that of the Canadian fiber, and for that reason it is better for insulating purposes.

Electricity in Woodworking Plants.

By E. G. Fox.

This article discusses the general advantages of motor drive for woodworking plants, with comment on the relative advantages of group and individual drive. Considerable data are also given on the horsepower required for various woodworking machines under operating conditions.

The tools of the early woodworker were, no doubt, a plane, an auger, a saw and a hammer. These were manipulated laboriously by hand to fashion the crude articles of daily use. With the arrival of sources of power generation new woodworking tools were devised essentially as a means for applying power to woodworking processes. Manual labor is now used only to control the tools and to feed the material. A horsepower-hour of human effort costs dollars where a horsepower-hour of mechanically generated power costs cents. It should be evident that the great advance in woodworking industries is directly due to the perfecting of methods of applying power to the work. With this in mind the importance of the subject of power application will be more fully appreciated. Power is not for driving machinery; it is for furthering productive processes.



20-Horsepower Motor Direct-Connected to 30-Inch Double Planer.

In the woodworking industry as in most others, line shaft and belt drive has long predominated as a means of power distribution and has gained a strong hold through usage. Motor drive must have real advantages to supplant existing methods. What advantages can be gained by motor drive and how can those advantages be best realized?

The application of power to woodworking processes by means of special tools has greatly increased production and lessened labor cost. Motor drive affords the greatest advantages of increased production due to the most effective application of power to the special tools. As the replacement of manual with mechanical power has advanced the industry, so will the more efficient application of power through motors have like effect.

Maximum output demands most effective cutting speeds constantly maintained, together with regular feeding of material. Motor drive shows a great advantage over shaft drive through speed maintenance. Woodworking machines commonly operate at high speeds and are driven by slow-speed

prime movers. Necessarily there must be several intermediary shafts or else wide pulley ratios for a few. Either condition encourages fluctuation of speed with load. In practice it is found that shaft-driven machines vary in speed ten to twenty per cent from no load to full load. This has a very real effect upon output, particularly for power-fed machines. Not only does a machine slow down because of its own load but it is also affected by other machines in its group. In some cases machines have been found to run ten per cent slower at one time of day than another, depending upon the load in the department. By the use of motor drives most or all of the intermediate shafting and belting may be eliminated. Speeds are maintained through elimination of slippage and through independence of drives.

The importance of speed maintenance cannot be overestimated. Let us consider an actual case. A 26-inch planer was found to run 3,800 revolutions per minute without load and 3,250 revolutions per minute with load. The best cutting speed was about 3,500 revolutions per minute. This machine was turning out about 12,000 board feet per day. If the working speed were maintained at 3,500 revolutions per minute the output would be 13,000 board feet. The value of this process is about $1.00 per 1,000 board feet. Consequently in a year of 300 days the value of increased production is $300. This is materially more than the cost of installing an individual motor. As was previously stated, speed losses of ten to twenty per cent are very common with shaft and belt drives. The consequent shortage in production in plants having many machines is enormous.

Motor drives also affect the second consideration of securing maximum output, that of handling the material and feeding the machines. Motor drive permits the most advantageous placing of machines and leaves the space about them clear for passage. This is an important consideration in woodworking plants because of the bulkiness of the material handled.

Independence of drives also prevents production losses due to shutdowns. Woodworking plants generating their own power can usually secure breakdown service from local electric plants. Shutdowns in public service plants are now almost unknown, so that a manufacturing establishment purchasing power or having provision for breakdown service has the best of insurance covering this essential.

Secondary to increased production is the saving in power effected through motor drives. Most woodworking machines seldom operate at average loads anywhere near the maximum load. It is necessary, however, to provide power-transmission equipment suitable for the maximum load ever imposed. Line shafting or belting must be large enough to handle loads much heavier than are normally transmitted. This results not only in high first cost but also in increased friction losses, so that the power actually consumed at the tool itself is less than that consumed in friction in getting the power to the machine. Shafting and belt losses are almost entirely eliminated by using motor drive. Individual motor drive permits the delivery of the maximum percentage at the driven tool of the total power generated.

The minor advantages of motor drive are:

Lower maintenance costs. Belts in woodworking establishments must be kept very tight to prevent excessive slippage. Belt replacements average nearly 40 per cent. The cost of keeping belts tight and in order is considerable. Most woodworking plants are of mill construction and settle so that the shafting requires re-alinement from time to time to prevent excessive friction.

Motor drives are safer due to the elimination of belting and shafting.

Quality of work is improved through uniform speeds and better light.

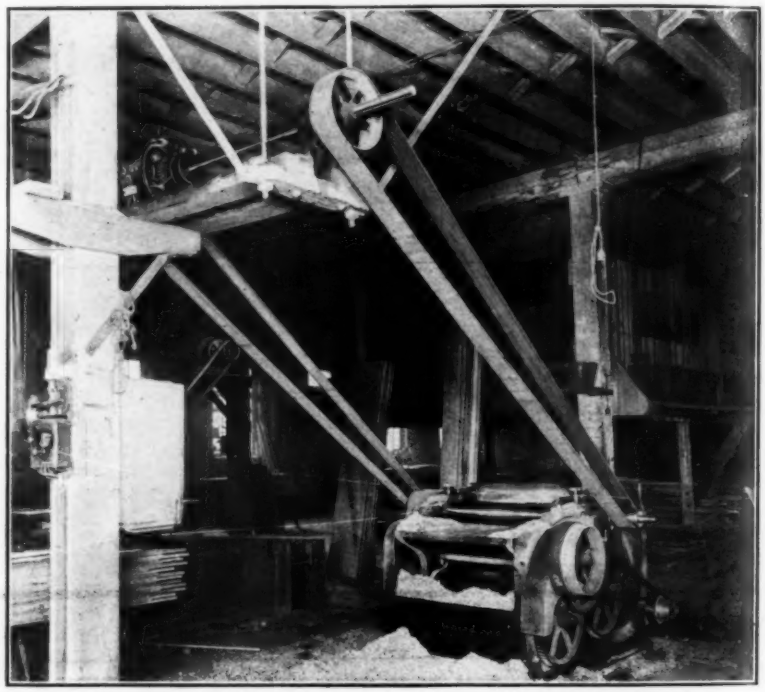
Lighter construction of buildings is allowable when there is no heavy shafting to be supported.

Fire risk may be decreased by placing the boiler room in a fireproof isolated building.

Fused motors provide a factor of safety protecting the machinery.

The first consideration in planning a system of motor drive for a woodworking plant lies in the degree of subdivision of power units advisable. Should the machines be grouped, or driven by individual motors? There are a number of advantages of individual drive but its universal use is not altogether warranted.

Direct connection of the motor to the driven shaft insures minimum speed losses. As most woodworking machines operate at high speeds they are equipped with small driven pulleys and there is sure to be considerable slippage with belt drives. The point has been made that the greatest advantage of motor drive is in speed maintenance to procure increased production. This point should not be lost sight of in making the application and the means should be designed to secure the maximum benefit.

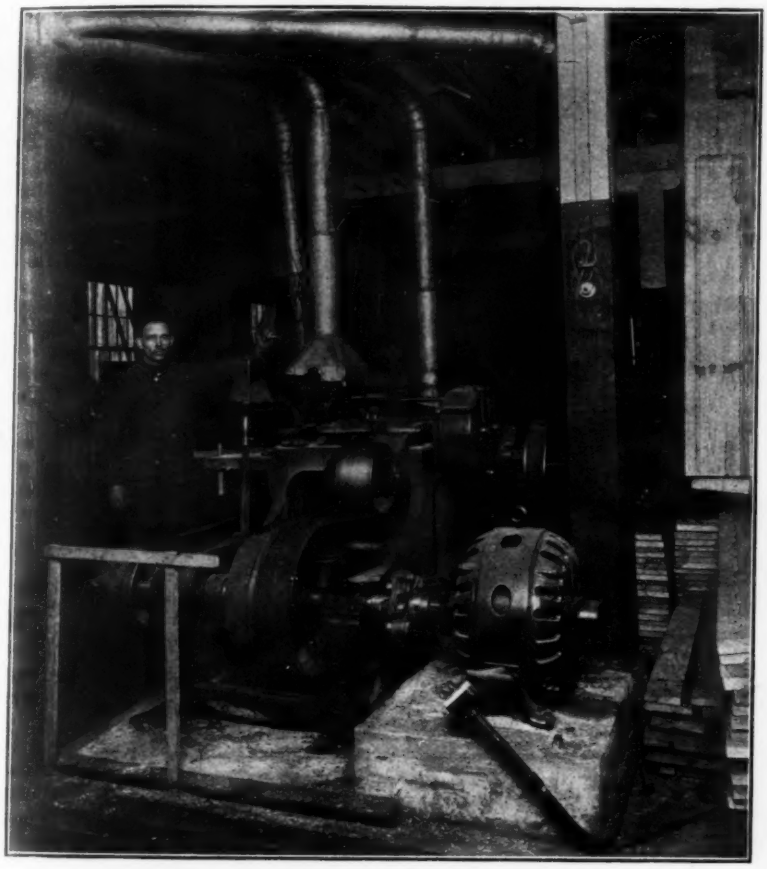


Showing Long Armature Shaft With Additional Outboard Bearing for Belting to Planer.

If each machine be supplied with an individual motor, this comprises a unit which can be located independently of all considerations of drive. Individual drive therefore allows the most advantageous arrangement of machines for maximum production due to the greater ease and rapidity of handling material. The tendency in woodworking plants as in metal working is to speed up tools and power-fed machines. Hence the output of a ma-

chine tends to become greater, requiring better methods of handling and better relative arrangement of tools to get the stock to and from them. Individual drive lends flexibility and ease of re-arrangement in future changes.

Individual drive permits maximum ease in handling the machines for stopping and starting. Independence of drive lessens losses from breakdowns. Where machines operate intermittently individual drive permits shutting down the machines not in operation. All transmission losses then stop.



15-Horsepower Motor Direct-Connected to 10-Inch Molding Machine.

This reduces the cost of power. Decreased power consumption not only decreases power cost but allows the use of smaller generating equipment.

Group drive is generally cheaper in first cost. It can be advantageously employed for hand-feed machines where production is largely a matter of speed of the operator rather than speed of machine. It can well be used for small machines requiring little power and handling small stock. It is often best when old machines are retained which may ultimately be displaced or removed. It can be used for small machines continuously operated. It is sometimes advisable where machines require heavy starting torque, such that a larger motor would be required to start than to drive them. When such machines are grouped the larger motor is ample to handle the heavy starting torque of machines not starting simultaneously, the peak being relatively smaller compared to the capacity of the motor.

Alternating-current motors are the type best suited for woodworking plants. Woodworking machines almost without exception operate at constant speeds. The alternating-current squirrel-cage motor is unexcelled for this type of drive. Woodworking machinery runs at high speeds. Squirrel-cage alternating-current motors are at their best under this condition, whereas direct-current motors are less desirable for very high speeds. Sixty-cycle induction-motor speeds approximate closely the speeds of driven shafts of most woodworking machines so that direct connection of individual motors is possible.

Squirrel-cage motors are very simple and reliable and have no brushes to wear and give trouble. Large temporary overload capacity enables them to handle the peaks common to machines in this industry. Absence of sparking decreases the fire risk. In addition to these advantages the cost of an induction-motor installation is usually less than that of a direct-current motor installation.

Most woodworking machines may be divided, for purposes of power application, into two general classes, those which are hand fed and those which are power fed. In the former class, hand fed, the service is more or less intermittent, depending upon the rate at which the operator feeds the stock. Under this class are included: shapers, boring machines, hand-feed rip and cut-off saws, lathes, hand-feed joiners, belt and disk sanders, scroll saws and jig saws. With machines of this sort the maximum load exists for but a small portion of the time. The load of the machines is comparatively small and the inherent overload capacity of the motors, particularly if of the induction type, is sufficient to carry the machine over the peaks. Hence, smaller motors can be used than in the case of power-fed machines. The tendency of hand-fed machines to operate without load a portion of the time lends one disadvantage in the use of induction motors, due to the fact that small induction motors have a poor power-factor at partial loads. This is one point in favor of grouping a number of intermittently hand-fed machines upon one larger motor so that the diversity-factor will cause the larger motor to carry a load more continuously.

With power-fed machines the work is usually fed as fast as it can be machined. Hence the motor must be capable of carrying full load almost continuously. The inherent friction of power-fed machines is much greater than that of hand-fed machines and of the two machines running light, the power-fed machine requires the greater load. Hence the motor on a power-fed machine carries a more continuous load aside from the more regular feed. The power-fed machine will turn out much more work in most cases than the hand-fed machine, so that the power required per unit of output is less for the power-fed machine and the time required in the machine is often less. Power-fed machines are of the type enumerated in the following list, but a few of the total number being given: planers and matchers, molders, stickers, self-feed rip saws, scraping machines, resaws and tenoners.

The power required to drive woodworking machinery varies greatly under the different conditions of operation and the classes of work. Some of the main factors influencing the loads are: design of the machine itself; power-fed machines differ more than hand-fed machines in inherent friction load. Speed at which the work is done, comprising feed and depth of

cut. Condition of the machine and cutters. Kind of material. Machines handling but one kind of material may be motored for their ordinary load, whereas machines used for diverse operations must be equipped for their heaviest service.

Some data are here given covering the motor sizes recommended for woodworking machines. The data are based upon numerous tests as well as the data given by manufacturers. As a guide they should be helpful. However, modifying conditions of individual cases must always be considered. Figures are for modern machines in normal condition handling medium woods. The figures are sufficiently liberal for most cases. Care should be taken to prevent overmotoring because of loss of efficiency and low power-factor affecting the generators.

Band Saws and Band Resaws.

All band saws possess considerable inertia and require motors with good starting torque. With resaws this condition is particularly true and motors should be capable of developing 1.5 times full-load torque at starting and should have good overload characteristics. With alternating-current squirrel-cage motors high-resistance end rings give the desired starting torque in a satisfactory manner. Wound-rotor motors must have their rings protected and are not strongly recommended, the high-resistance squirrel-cage motor being simpler and more satisfactory.

The speed of band saws depends upon the class of work, the kind of wood, width of blade, etc. Generally speaking, dimensions are standardized so that saws of a given wheel diameter use the same width of band, and operate at the same speed on similar work. Special attention should be given the saw-tension devices, as improper adjustments may result in excessive tension which imposes a heavy load upon the motor.

Resaws are apt to be called upon to work with the maximum stock for which they are designed so that liberal motor sizes should be adhered to, especially for hard woods.

Band Saws.

Diam. of Wheels, in inches.	R. P. M.	Max. depth of timber, inches.	Horsepower of Motor.
42	400-500	20	5
38	450	16	5
36	500	16	5
36	400	14	3
34	500	12	3
30	500	12	3

Belted motors are recommended for most installations because of slow speeds of driven shafts. Low-speed induction motors are costly and have poorer characteristics than high-speed motors of same type. If self-contained equipment is desired the motor can often be advantageously geared.

Band Resaws.

Diam. of Wheel in inches.	R.P.M.	Width of Saw blade, inches.	Max. depth timber, inches.	——Motor—— Horsepower	R.P.M.
60	550	8	36	50	600
54	600	6	30	40	600
48	650	5	26	30	720
44	650	4	24	20	720
42	650	4	24	15	720
40	700	3	20	15	720
38	450	2	12	7.5	514

The above table represents average values taken from a number of manufacturers and modified by tests. Do not use smaller motors than suggested. Add for jointing attachment on 48-inch saw, 7.5 horsepower.

Band Rip Saws—Power Feed.

Diam. of Wheels, inches.	R.P.M.	Max. Size timber, inches..	——Motor—— Horsepower.	R.P.M.
42	650	12	15	720
40	600	15	10	600

Add 2 horsepower for return rolls if used. Use high-resistance rotor preferably if alternating-current induction motor is used. For direct-current use compound-wound motors. Speeds given are for direct connection.

Scroll Saws—Hand Feed.

Two-horsepower motor required for ordinary saws of this type. If direct-connected a 900-revolutions-per-minute-motor is generally correct. Scroll saws operate with a reciprocating motion from a connecting rod, the saws being from 14 to 16 inches long.

Circular Saws.

Circular saws are not as much used for resawing as band saws, as they require more power, cannot run at as high speeds and waste more stock. They are cheaper, however. Splitting with circular saws requires from 15 to 20 per cent more power than cross cutting, whereas band saws require about the same power for both.

Max. Diam. Saw, inches.	R.P.M. of Saw.	——Capacity—— Horizontal, inches.	Vertical, inches.	Horsepower.
42	900	17		25
36	1,000	14		25
32	1,225	11	8	20
30	1,200	10	6	20
24	1,225	8	6	20

Motors can usually be direct-connected to countershafts which run about 600 revolutions per minute in most cases.

Circular Rip Saws.

Max. Diam. Saw, inches.	Max. R.P.M.	Max. thickness stock, inches.	Feed. Feet per minute.	Horsepower.
20	2,100	6	60-180	15
16	2,600	5	64-194	15
12	2,400	2	50-100	7.5

Motors can usually be direct-connected to countershaft under the machine which runs at about 900 revolutions per minute generally.

Hand-Feed Circular Rip Saws.

Max. Diam. Saw, inches.	Saw R. P. M.	Horsepower.
14	2,700	7.5
16	2,400	10
20	2,000	15
24	1,600	15
30	1,250	20
36	1,000	20

Where speed of saw shaft permits it is sometimes possible to connect the motor direct to this shaft. Otherwise belting is necessary. Direct-connected machines maintain speeds better than belted machines. Most rip saws of the above type have very intermittent loads. The above values are high enough for hard woods.

Power Feed Gang Ripping Machine.

No. of Saws.	Max. R.P.M.	Diam. Saws, inches.	Feed. Ft. per min.	Horsepower.
2	3,400	10	180	15
3	2,300	15	200	30
4	2,500	14	100 to 180	25
Power feed gang edger and ripper.				
8	2,500	14	90 to 200	35

Circular Cut-Off Saws.

Max. Diam. Saw, inches.	R. P. M. of Saw.	Horsepower.
14	2,700	5
16	2,600	7.5

Power feed cut-off saws are usually for heavy work in large amounts. They use 7.5 to 10-horsepower motor, depending upon the work.

Swing Cut-Off Saws.

This type of circular saw is used to cut equal lengths to square ends. The saw runs light the greater portion of the time while the stock is handled. The power required in the cut exceeds the figures given but the overload capacity of the motor will handle these intermittent peaks.

For very heavy work use....20 hp. motor.
For heavy work.....15 hp. motor.
For medium work.....7.5 hp. motor.
For light work..... 5 hp. motor.

The third class is for ordinary work in most factories where stock 8 inches square is not exceeded.

The fourth class is for boards not thicker than 1.5 inches. Motors for this work must be belted, the motor being mounted upon the swinging bracket of the saw frame.

Double Cut-Off Saws.

Max. Diam. Saw, inches.	Max. thickness timber, inches.	——Motor—— Horsepower.	Speed.
16	4	10	600 or 900

Motors can usually be direct-connected to the countershaft of the machines underneath, the motor speed being selected to suit.

Where work averages about 6.5 to 12 inches cross section of cut at one end, a 5-horsepower motor is ample. This is the condition met in many plants.

Inside Molders.

Max. capacity, inches.	Horsepower.
8 by 4	25
10 by 4	25
12 by 6	35
14 by 6	35

Outside Molders.

Max. capacity, inches.	Horsepower.
4 by 4	10
6 by 4	15
8 by 4	20
10 by 4	25
12 by 5	30
14 by 6	35

Stickers.

Max. Size timber, inches.	Horsepower.
16 by 4	5
18 by 4	7.5
20 by 4	10

Planers, Surfacers and Jointers.

The depth of cut, width and kind of timber, rapidity of feed and condition of knives are factors influencing largely the power required by these machines.

Jointers.

Max. Width Timber, inches.	Horsepower.
8	2
12	2
16	3
20	5
24	7.5
36	7.5

The speed of cutter heads depends upon the type used, whether there are three or four cutters. Where the head is to revolve at 3,400 revolutions per minute it is often possible and desirable to direct-connect the motor using perfectly flexible-flange couplings.

The above horsepower recommendations are based upon a maximum depth of cut of three-thirty-seconds inch. If this cut is to be exceeded it would be advisable to increase the motor size to correspond.

Max. Size Timber, inches.	Horsepower.
20 by 16	60
20 by 18	60-75
20 by 20	60-75
30 by 18	75
30 by 20	75

Drum Sanders.

In some classes of work, such as the manufacturing of doors, it is frequently required that articles must be sanded to size. This requires that considerable material must be removed by the sander in many cases and greater power is therefore required. In most factories this condition does not obtain. The figures given are for general sanding, not to size.

Where material is sanded to size and full width of sander is used with panels fed continuously, add 5 horsepower to the motor sizes given above.

Scraping Machines.

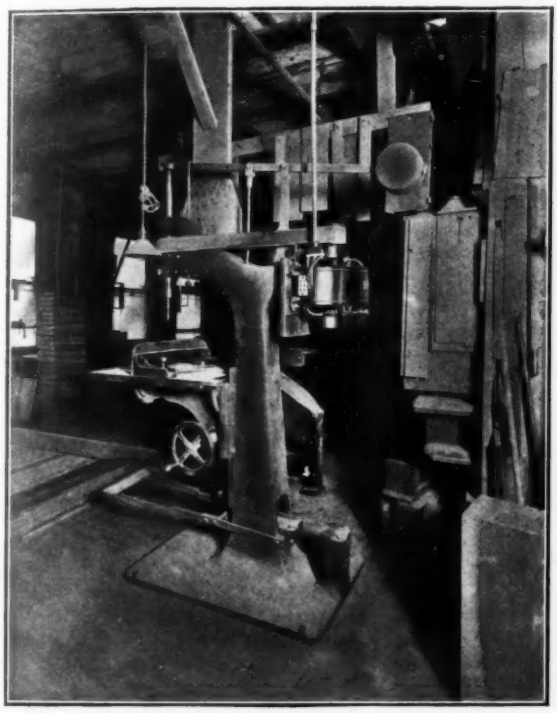
Max. Width Stock, inches.	Horsepower.
12	2
26	3
30	3
42	5

Chisel Mortising Machines.

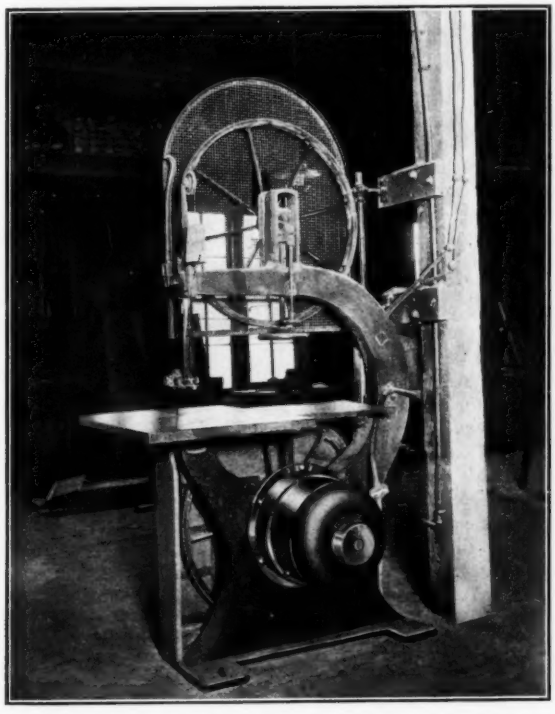
Max. No. Chisels.	Max. Size Chisel. Square.	Horsepower.
1	0.5	2
1	0.75	3
1	0.75	3
1	1.25	5
2	1	3
3	1	5
4	1	5
5	0.8125	5
6	0.8125	7.5
7	0.8125	7.5

Borers.

No. Bits.	Max. Diam. Bit. inches.	Horsepower.
1	1	3
1	2	5
2	0.75	3
3	0.75	5
4	0.5	5
8	0.5	10



Vertical Ball-Bearing Motor Driving Boring Machine.



Slow-Speed Totally Inclosed Motor Direct-Connected to Band Saw.

Single Surfacers.

Values here given are for medium heavy work where cuts of not more than one-eighth inch are taken. For planing-mill duty involving heavy stock and deep cuts the motor sizes should be increased about 5 horsepower.

Max. Width Timber, inches.	Horsepower.
16	7.5
20	10
24	10
30	15
36	15

Double Surfacers.

Max. Width Timber, inches.	Medium Work. Horsepower.	Heavy Work. Horsepower.
26	20	35
30	25	35
36	30	

Timber Sizes.

For dressing timber to size, surfacing four sides simultaneously, the following figures are given. They apply to heavy service.

No. of Drums.	Size Sander Max. Width stock, inches	Horsepower
1	30	10
1	36	15
1	42	15
2	30	20
2	36	20
2	42	20
2	48	25
3	30	20
3	36	25
3	42 & 48	30
3	54 to 66	35
3	72	40
3	78	40
3	84	50

Tenoners—Hand Feed.

Length of Tenon, inches.	Horsepower.	
7	7.5	Single
7	10	Double

Shapers.

For ordinary service on reversible single or two-spindle machines use a 5-horsepower motor. For extra heavy work such as in carriage factories, railroad shops, etc., use a 7.5-horsepower motor.

Automatic Lathes.

Max. Diam. and Length of Stock, inches.	Horsepower.
2.75 by 52	10
3 by 50	15
3 by 50	20
5 by 50	20

Planers and Matchers.

For planing and matching timber at one operation.

Max. Size timber, inches.	Horsepower.
9 by 6	35
15 by 6	40
20 by 6	45
24 by 6	45
26 by 8	45

Box-board matchers are similar to the above except that the work is much lighter. Hand-feed box-board matchers usually require a 7.5-horsepower motor, while power-fed machines require a 10-horsepower motor.

Commercial Practice
Management, Rates, New Business

Public Service Company of Oklahoma Holds Show.

With the assistance of the local electrical dealers and contractors, the commercial department of the Public Service Company of Oklahoma, under the management of J. L. Terry, recently put on the first electric show ever held in the State.

Oklahoma is dry, and that probably accounts for the Grill Room of Hotel Tulsa, the leading hotel, in being chosen as the place for holding the Show. It was a wise choice, for being located in the heart of the business section, and with banners strewn throughout the downtown district, inviting everyone to the scene of the display and demonstration and judging from the thousands of people who visited the show and pronounced it a huge success, there could have been no mistake either in the location or the manner of extending the invitations.

About three days before the beginning of the demonstration, printed invitations were mailed by the Public Service Company, to every one of its residential lighting customers and to all prospective customers. The invitation was neat and attractive, and it is believed that the majority of persons receiving them, attended the show. News articles appeared daily in the local newspapers, giving interesting accounts of the exhibits and demonstrations of the day before, and these served to stimulate the interest which was manifested during the entire week.

No special effort was made at taking orders for appliances, the principal idea being to educate the public to the many uses of heating, cooking and other household appliances. However, numerous sales were made directly at the show, and many prospects were listed which should soon materialize into sales.

The venture was a huge success both from the standpoint of the dealers who will profit by the sale of appliances, and to the central station whose day load will be greatly increased by the many new devices sold.

Free Fan Service for the Sick.

The Louisville Gas & Electric Company has advised the physicians of Louisville, Ky., that it will furnish their indigent patients with free electric-fan service this summer, when the fan would be advisable and when the patient is not able to pay for its installation. The company, through Robert Montgomery, manager of the commercial department, has stated that it will lend fans and, where that is necessary, will install temporary wire connections to supply the power. One formality is required and that is that the doctor must in writing ask that the installation be made.

Public Utilities Company Shows Increase.

The commercial showing of the subsidiaries of the American Public Utilities Company in 12 different cities for the week of May 16, 1914, when compared with a similar period of 1913, is remarkably satisfactory. The output of gas and electric current shows increases ranging from 5 to 40 per cent. The increase in the amount of gas used is natural and was to be expected, due to the growth of the communities in which the companies are located and to the fact that the modern method of cooking is being almost universally adopted.

The increase, however, in the amount of electric current manufactured and marketed is more significant and important for the reason that at all the plants where electricity is made there is more or less current used for power for manufacturing purposes. Taking into consideration the general conception of rather unsettled business conditions, the increase in output of electric current is very encouraging, showing a tendency toward the restoration of industrial activity.

Extension From Louisville System.

Electric service will be made available to a well populated territory east of Louisville, Ky., by the extension of the transmission lines of the Louisville Gas & Electric Company nine miles in that direction. Service is given now as far east as Anchorage; the extension will go to Crestwood in Oldham County. Some 240 contracts are waiting, sufficient to justify the extension. The region is highly favored as a location for the country homes of wealthy Louisville people, besides, several manufacturing enterprises will be within reach of the service.

Demonstration Building for Cincinnati Central Station.

The Union Gas & Electric Company, operating the light and power system serving Cincinnati, O., has leased a three-story building at 405 Race Street, in the retail business section of the city, for the purpose of makng a continuous demonstration of the numerous uses to which electricity can be put in the household. The first floor is to be devoted to the various novelties using electric current, while in the basement and the two upper floors strictly practical goods will be shown and demonstrated. An up-to-date laundry will take up most of the basement space, the great convenience of electric current in this branch of household work being shown, while on the third floor a kitchen and dining-room, completely fitted up, will be used to demonstrate the various uses of electricity in cooking and serving, as well as in lighting. The second floor will be of especial interest to builders and prospective owners of homes, as it will be divided into booths representing the various rooms of a house, showing the proper distribution of electric fixtures, the various attachments and current-consuming devices which may be used, and so forth. On this floor also will be installed a restroom for women shoppers, which is expected to prove very attractive to patrons of the fair sex as it will contain electric curling-irons and massage machines. The lease calls for possession on June 20.

Socialist Administration Ready to Sell Municipal Electric Plant.

Preliminary plans are well under way for the sale of the municipal electric lighting plant of Martin's Ferry, O., by the present administration of that city. Bids have been submitted by two private corporations, the Sunnyside Electric Company and the Wheeling Traction Company. Although the present administration is a Socialist one and it is a known fact that municipal ownership is strongly advocated by the Socialists, the members of that party now in power at Martin's Ferry are favorable to the sale of the plant. The chief cause for selling the plant was the fact that it cost the city annually almost double the offer made by either company.

St. Louis House-Wiring Campaign.

From time to time we have recorded the progress that is being made in the campaign for house-wiring business conducted by the Union Electric Light & Power Company, of St. Louis, Mo. The accompanying illustration shows one of a series of newspaper advertisements that has been used and to which many profitable inquiries can be traced.

The wiring plan referred to provides for the wiring of four ceiling outlets and one baseboard, all on the same floor, for $17.95. This is the minimum rate, but many of the small houses and cottages have been secured on this basis. The customer is allowed 12 months in which to pay the account.

LIGHT
At Your Finger's End
Every minute of the day or night—that's the convenience you derive from Electric Light—in addition to its many other comforts.
Wire Your House
now, and be ready to use an Electric Fan during the coming Summer season.
4 Ceiling Outlets and 1 Baseboard Outlet (all on same floor) $17.95
You Have 12 Months' Time to Pay
Illustrated Catalogue with full particulars sent free on request.
Shall we send our representative?
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Union Electric Light & Power Co.
UNION ELECTRIC
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SERVICE

Advertisement of Union Electric Light & Power Company.

Large Power Contracts at Omaha.

The contract department of the Omaha Electric Light & Power Company has closed a contract with the Cudahy Packing Company to supply all electrical power used in that company's plant at South Omaha. This aggregates 800 kilowatts, operating at about 60 per cent load-factor.

Another recent contract closed was for supplying about 250 kilowatts to the Burgess-Nash department store in Omaha. This store has previously had in turn its own steam, gas engine and gas-producer plants which are now being superceded by central-station service.

New Electric Shop for Pittsburgh Central Station.

The Duquesne Light Company, of Pittsburgh, Pa., has opened a new electrical store in the Jenkins Arcade Building, at the Liberty Street entrance. Several new electrical appliances are being demonstrated at the store, among which is a new electric washing machine. A very novel means of advertising has been employed to advertise the machine. Soiled paper money taken into the Diamond National Bank is run through the washer and thoroughly cleansed; it is then electrically ironed until it becomes dry. In this way it is shown that the most fragile material can be washed and ironed by the machine without any ill effects. This remarkable exhibit draws crowds of people to the windows of the store every day.

Co-operation Between State and Utility Companies.

A three-cornered contract has been entered into between the State of Utah, the Utah Power & Light Company, and the Utah Light & Railway Company for the transmission of electric power from the State's plant in Logan Canyon to all of the State institutions.

The State built a power plant in Logan Canyon three years ago, intending to supply all of its institutions from this plant, but until the present time a satisfactory arrangement for the transmission of this power has not been arrived at.

Under the terms of the present contract, the Utah Power & Light Company transmits the power from the State power plant in Logan Canyon to Salt Lake City, Ogden, and Provo over its high-tension transmission lines. At Salt Lake City and Ogden the current is turned over to the Utah Light & Railway Company, which transmits it over its distribution system to the State Capitol Building, University, Penitentiary, the Industrial School, and the School for the Deaf and Blind. At Provo, the Utah Power & Light Company transmits it over its secondary distribution to the State Mental Hospital.

The State power plant furnishes, in addition to the energy consumed by these various institutions, sufficient energy to compensate the transmitting companies for the loss in their system, and the State pays to them as compensation for this transmission service at the rate of 1.5 cents per kilowatt-hour for all energy delivered.

Governor Spry declares that the contract is a highly advantageous one to the State.

New Business Campaign in Small Town.

The Fort Scott & Nevada Light, Heat, Water & Power Company, of Nevada, Mo., will give during the next thirty days a six-pound electric flatiron to each new residence service connected with the company's lines. The offer is a part of a campaign for new business, the local contractors agreeing to bear half of the cost of the irons, which are valued at $3.50 each The city's population in 1910 was 7,176.

Kansas City, Kans., Utility Controversy Settled.

The Standard Electric Light Company, which has operated in Kansas City, Kans., for some time past without a franchise, has reached an amicable agreement with the municipal authorities as to future operative methods. The city contended that the Standard company had no right to operate in Kansas City, Kans., and recently ordered the company to remove its wires. Under the new agreement, however, the light company may continue to sell its heavy power service. In return for this privilege, the company will discontinue its commercial light and light power service by March 1, 1915. It also will remove its poles by that time, except those needed for heavy power service, and will accept new customers only with the approval of the municipal authorities. A sum of $60,000 due from the city on old accounts, is to be diverted to the construction of a viaduct at Eighteenth Street and Muncie Boulevard. The city of Kansas City, Kans., on the other hand, will pay $60,000 annually to the Standard for arc lights at the rate of $55 each.

Campaign on Electrical Devices During Matrimonial Month.

The "June bride" season is cleverly taken advantage of by Robert Montgomery, commercial agent of the Louisville Gas & Electric Company, in the advertising being done by the company this month. Electrical utensils as wedding gifts are featured in all the papers in connection with the company's house-wiring campaign advertising. The company has put on also a special display of these utensils at its offices and every advertisement contains an invitation for wedding principals or prospective wedding guests to visit this display or "the showroom of any electrical merchandise store."

Fan Season Stimulates Wiring of Louisville Houses.

The signing last week of seventy contracts for the wiring of houses in Louisville, Ky., brought the number written since the campaign was begun in that city several months ago up to 915. These have been obtained by the solicitors of the Louisville Gas & Electric Company, while it is estimated that the solicitors for the independent contractors have got altogether as much again of this kind of business. In the hot weather which has prevailed in Louisville recently, the solicitors and the newspaper advertising of the company have emphasized the fact that wiring will permit the use of electric fans.

Damage Suit Resulting from Slipshod Accounting.

A prominent central-station company has just paid to a druggist in its city $5,000 as damages which resulted from misplaced records at the offices of the company. The druggist was one of the collectors for the company, that is, he was authorized to receive payment of the company's bills, an accommodation to the consumers in the neighborhood of his store. Between December 21, 1913, and January 2, 1914, he collected some $575 and turned it over to the company. In some way the record was confused and shortly the company began sending letters to the consumers in the druggist's district, reminding them that their bills were past due. These customers demanded explanations from the druggist and he, eventually, brought suit alleging that his reputation and business had been damaged. The company has lately admitted its error and the verdict for the plaintiff was peremptory, the jury fixing the damages at $5,000.

Sign and Window Lighting Campaign in New Bedford.

The New Bedford Gas & Edison Light Company has recently been conducting an electric lighting campaign, primarily to increase consumption through sign and store-window illumination. On a basis of a minimum of 150 kilowatt-hours per month, the company agrees to supply electric energy for exterior lighting, sign, and window lighting at a price of five cents per kilowatt-hour.

The agreement used provides that the current is to be furnished every night from dusk until 11 o'clock, and is to be turned on and off either by a time switch or similar device arranged by the company, or by a patrol maintained by it.

The number and size of lamps cannot be changed without the consent of the company, and all burned-out and broken lamps are to be replaced by the consumer at his own expense. The contracts are for a period of one year.

Not Required to Furnish Street-Lighting at a Loss.

Judge F. S. Deitrich has declared void the contract between the Idaho-Oregon Light & Power Company and Boise City, Idaho, under which the former was to furnish service for the new street-lighting system at a rate of $11.24 per light per year. This contract was made under severe competitive conditions prior to the appointment of a receiver for the Idaho-Oregon Company. The receiver objected to complying with the conditions of the contract on the ground that to continue to furnish the service at this price would result in a loss to the creditors of the company.

Louisville Municipal Ordinance Regulating Gas and Electric Utilities.

Methods for testing gas and electric meters, regulations for the conduct of gas and electric utilities and the appointment of a chief inspector and his assistants are provided in an ordinance which has just gone into effect in Louisville, Ky. The city officials had the benefit of consultation with several of the engineers connected with the government service in drawing up the ordinance, which is said to be similar to measures in effect in Philadelphia and other cities. In the way of regulations for the supplying of electricity, several testing stations are provided, it is required that the service shall be constantly up to the standard which the companies operating in the city shall stipulate, and detailed prescriptions are set forth for the management of the consumers' meters.

The only utility company operating in Louisville at the present time is the Louisville Gas & Electric Company, a Byllesby corporation, which is the result of the merger of three electric concerns and two gas companies.

The meter-inspection regulations require that every service meter shall be tested by the company immediately after installation and that it shall register correctly to within a one per cent variation. Periodical tests for various meters are prescribed. For instance, alternating-current meters rated above 150 amperes shall be tested once each year. Additional tests may be obtained by the consumer on the payment of a fee of 50 cents to the city inspector. If such meter shall be found to be more than four per cent fast, the company supplying the service must restore the fee to the consumer and credit him on the basis of his bills for the previous three months. If the test shows that the consumer has been favored, the company may charge him accordingly, while if the test shows that the meter is neither fast nor slow, within four per cent either way, the consumer does not recover his fee. Penalties are provided for the violation of the terms of the measure.

Hotel Changes to Central-Station Service.

The New Ferron Hotel recently bought by Russell Brothers, has been transferred to the list of subscribers of the Paducah, Ky., Light & Power Company. When built by John Ferron, it was equipped with its own electric light plant and was so lighted during the short period that Mr. Ferron conducted the hotel. The new owners, however, decided in favor of the city service and sold the hotel's isolated plant equipment to the Mitchell Machine & Electric Company.

Electric Sign Data

Spectacular Electric Sign in Pittsburgh.

Through the courtesy of Betts & Betts, of New York City, we are enabled to present, as the sketch idea for this week, data on a spectacular sign that has caused considerable favorable comment in Pittsburgh. The sign is the work of G. G. O'Brien, Pittsburgh's foremost out-door advertising man, and is installed on a roof facing the incline leading to the main entrance of the Pennsylvania Station, this being considered the best possible location for an electrical display in the Steel City.

The effect obtained is very clever and unique. As will be noted by reference to the two accompanying illustrations, the sign reproduces a modern American baseball game and the action and positions are so natural that one almost feels he is witnessing an actual game.

By means of a special Betts & Betts flasher the player representing the pitcher goes through all the antics of a typical professional "southpaw," finally throwing the ball, which is seen to go through the air towards the batter. The batter misses, after a realistic swing, and the ball is returned by the catcher. The same action is reproduced, the batter this time making a foul hit. The third time the pitcher throws the ball the batter makes a short hit, which the pitcher catches. The photographs reproduced here show the first and last stages of the operation. Suitable color effects are obtained by means of Betts & Betts color caps.

Photograph of spectacular sign installed in Pittsburgh, Pa., by G. G. O'Brien.

By means of Betts & Betts flasher a typical baseball game is reproduced, the first and last motions being indicated from the two illustrations above.

Betts & Betts color caps and electric "Klok" mechanism are used.

J. C. Young, of the Iowa Railway & Light Company, Cedar Rapids, Iowa, is a strong booster for electric slogan signs. In a recent communication he says:

"Our slogan sign in Cedar Rapids is 'Cedar Rapids Suits Me, It Will You,' located at our main railway station, and has been the occasion for a great deal of favorable comment to Cedar Rapids by the traveling public, which, of course, is the very best kind of advertising. If this sign had accomplished this only it would have well paid the company for operating it free of cost for Cedar Rapids, as we do.

"I can not help but feel that the citizens of Cedar Rapids, and particularly the business men, must feel that this sign has added very materially to the general boosting spirit which the City of Cedar Rapids is noted for. We are well satisfied that it has been an investment that paid us both in actual money value in instigating business of our own as well as of value which results from a general feeling of good will toward the company.

"We have experienced the same advantages in Marshalltown, Iowa, and at present are anticipating the same for several other cities in which we operate."

Just before the current was turned into the new slogan sign which the City Light & Traction Company presented to Sedalia, Mo., every light and sign in the downtown section of the city was turned off for thirty seconds, leaving only the moonshine for illumination. When all the lights and signs were turned on again the new "Do-it-Electrically" sign was among them.

The scheme demonstrated very forcibly the part that electricity plays in making a city attractive at night.

Proper ceremony accompanied the launching of the new sign. There were a band, and speeches and an immense crowd.

The Sedalia *Capital* says:

"Sedalia has found from experience in the last year or two that electricity has done a great deal towards the development of the city. In the way of advertising and stirring up business it has accomplished a great deal not only for individuals, but for the city as a whole. That Sedalia is coming to be known as one of the best lighted cities in Missouri is worth a great deal of money, and the big, new sign turned on last night by the City Light & Traction Company is a very valuable and beautiful addition to the city."

Electrical Construction

ELECTRICAL INSTALLATION IN A HOTEL USING CENTRAL-STATION POWER.

Fort Dearborn Hotel, Chicago, Ill.

The new Fort Dearborn Hotel, Chicago, Ill., is located in the business section of the city and obtains its power from the 220-volt three-wire mains of the Commonwealth Edison Company. The hotel is a 16-story building with an attic and two basements. Electric energy is used for illumination purposes and a number of power applications such as ventilating fans, laundry machinery, water pumps, vacuum-cleaning pumps, elevators, etc. The complete electrical equipment including wiring for light and power purposes, telephones, etc., was installed by A. S. Schulman, Chicago, Ill., Holabird and Roche, of the same city, being the architects.

Connection with the three-wire power mains of the Commonwealth Edison Company is made through a pull box in the basement from where four 1,000,000-circular-mil and one 1,500,000-circular-mil paper-insulated lead-covered cables are carried through four 2.5-inch conduits and one three-inch conduit to a pull box from where the cables lead to a switchboard in the sub-basement. This switchboard distributes the power by means of two wire shafts and a number of independent circuits, a three-wire 110-220-volt system being used for lighting circuits and a two-wire 220-volt system for power circuits.

Fig. 1.—Construction Employed in Rear of Switchboard.

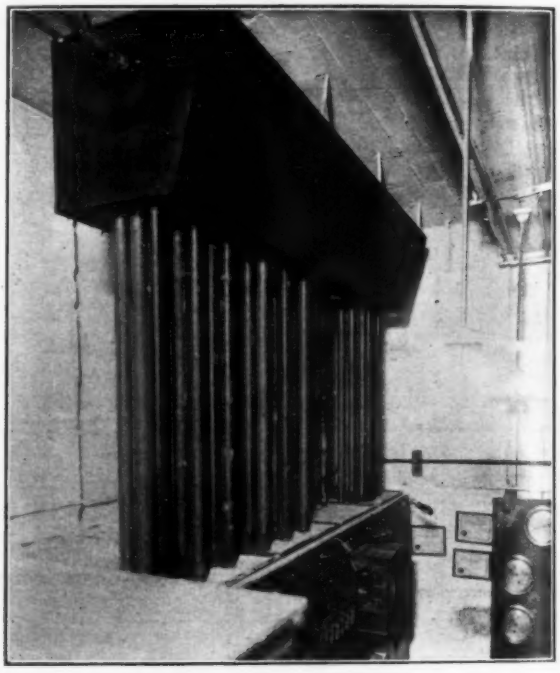


Fig. 2.—Switchboard Pull Box.

Fig. 1 shows the construction employed in the rear of the switchboard. Situated several feet from the back of the distributing panels of the switchboard, are slate slabs about one inch in thickness and about eight inches in width. These slabs are bolted to an angle-iron frame which also supports a steel plate approximately three-sixteenths of an inch in thickness extending from the top of the switchboard to a brick wall. The slate slabs are used to support N. E. C. standard inclosed fuses for the various circuits, the connections between the panel board, buses and fuses being made by round bare copper rods. Between these slate slabs and the panelboard are situated the various horizontal busbars. In the rear of the middle or service panel of the switchboard the slate slabs are mounted nearer the board than the other slate slabs. The slate slabs in the middle of the board are used to support the service buses and exposed copper service fuses. Fig. 1 clearly shows the result of employing this construction for the rear of the switchboard as the accessibility and neatness of the entire rear construction is apparent.

The steel plate extending from the top of the switchboard to the brick wall, is utilized as a means for supporting the conduits leading from the switchboard to the pull box hung from the ceiling above the board. For fastening the ends of these conduits to the steel plate, lock nuts are used on the top side of the plate and bushings at the under side. The passage in the rear of the switchboard is lighted by

means of several incandescent lamps supplied by an exposed line of conduit with porcelain condulet receptacles.

The pull box which is situated above the switchboard is shown in Fig. 2. This box is constructed of No. 10-gauge steel plates riveted with three-eighths-inch rivets to a 1.25x1.25-inch angle-iron frame. The front side is inclined about 10 degrees from the vertical and is removable being fastened by cap screws. The top side of the box is provided with eight one-inch

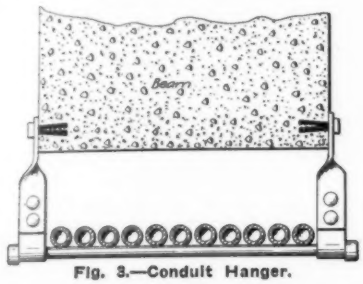


Fig. 3.—Conduit Hanger.

holes for the insertion of the hangers supporting it a few inches below the ceiling.

The service conduits and the feeding conduits all enter this pull box. Conduits are carried to two cableways for supplying the various floors, direct runs of conduit supplying the sub-basement with energy for power and lighting purposes. Throughout the building Sheraduct conduit is employed. In the basement, laundry, kitchen, etc., the conduit is exposed.

Fig. 3 shows the method of supporting several runs of small conduit in the basement. This hanger consists of a short length of iron pipe with pipe plugs at the ends supported from a beam by means of perforated iron strap the lower ends of the straps being bent around the pipe and fastened by

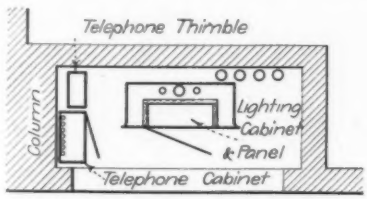


Fig. 4.—Layout of Lighting and Telephone Cabinets.

a bolt and nut. Single runs of conduit are supported by U straps fastened to either the wall or wood blocks depending upon the weight of conduit to be supported. In the laundry and other places where large rectangular ventilating ducts are suspended from the ceiling the conduit is often fastened to these ducts by means of U Straps and cap screws.

Fig. 8 shows how a run of conduit is led to a 5-horsepower motor driving a United Vacuum Cleaning Company's vacuum pump. It will be noticed that this conduit is bent to pass along the machine at a slight angle to the horizontal and is fastened to the iron frame of the machine by a U strap and cap screws. At the end of the conduit a porcelain bushing is employed, the wires between this bushing and the motor terminals being inserted in circular loom.

Fig. 5 shows the riser diagram. It will be noticed that two wire shafts are employed both of which are fed

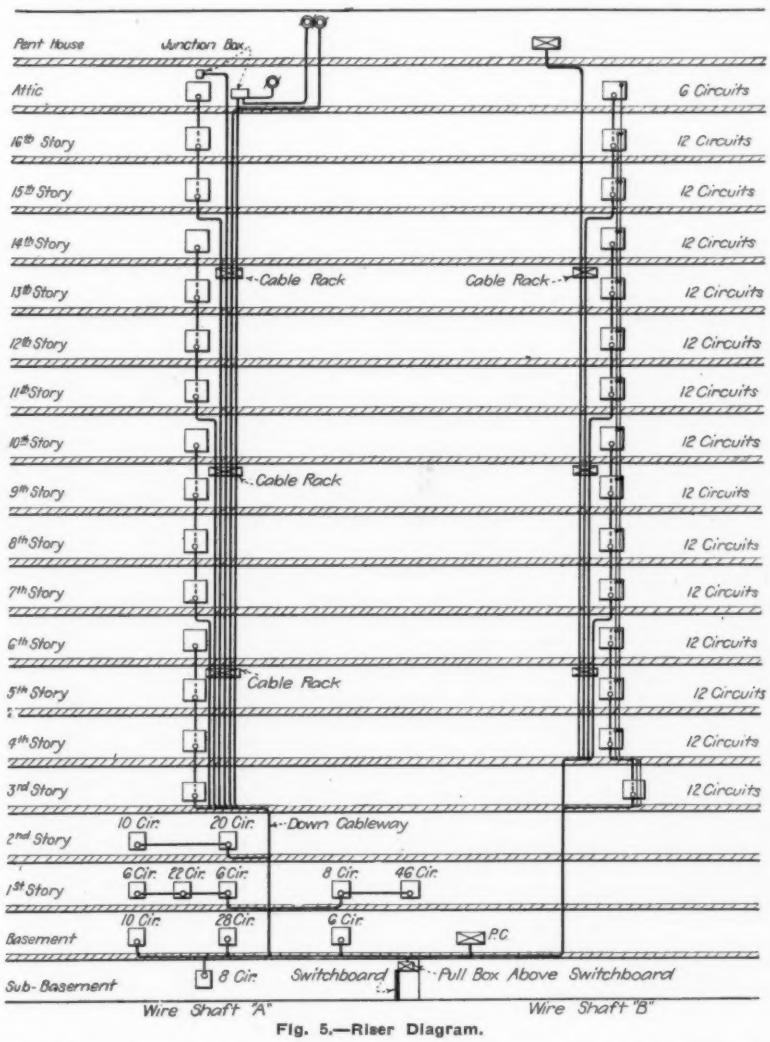


Fig. 5.—Riser Diagram.

from the main switchboard through the pull box above the board. Both 220-volt 2-wire risers and 110-220-volt 3-wire lighting risers are carried in the shafts. It will be seen that the three risers shown to the left in shaft "A" each supply four floors, the fourth riser supplying the last two floors and attic. The fifth riser is run to a junction box in the attic and is used for sign lighting. The two feeders on the right in shaft "A" are power feeders supplying the elevator motors with 220-volt power. A similar arrangement is employed in shaft "B" with the exception that two risers (shown to the right) are used to supply the energency lamps on all floors.

Three cable racks are employed in each shaft as shown. These cable racks consist of a steel plate to which the conduits are supported by U bolts, bushings being placed at the ends of the pipes. The wires are supported by means of porcelain cleats fastened to the same plate.

Figs. 4 and 7 show the layout and an actual view of the lighting cabinets employed throughout the main portions of the building. From Fig. 4 it is seen that the power and telephone cabinets are mounted in the same opening in a wall, the power cabinet being in the center of the space and the telephone cabinet to the side of the space. The cabinets are of sheet steel with plug fuses, the fuse receptacles being provided with porcelain mountings.

Closing these wall openings for the

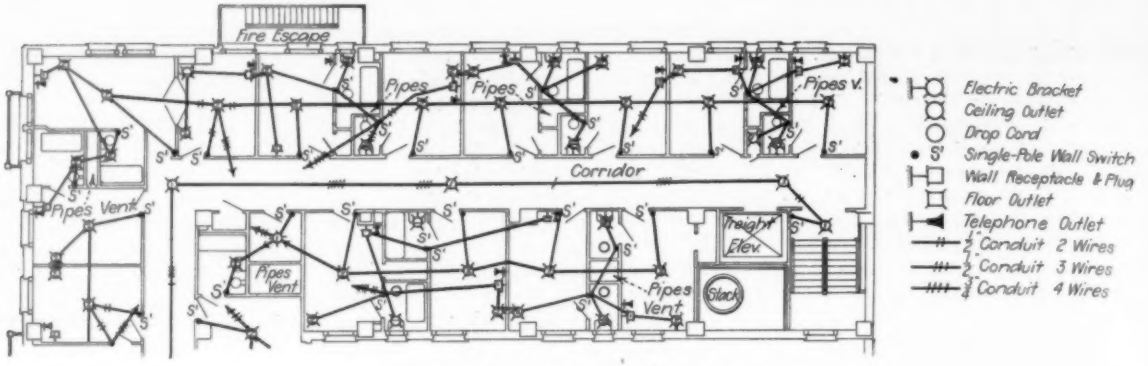


Fig. 6.—Wiring of Section of Typical Floor.

cabinets are wood doors of similar size and finish to those employed for closing the entrances to rooms. In this way the various cabinets can be located where desired, as they in no way interfere with the artistic effects, as would be the case if only small doors or exposed cabinets were employed.

Fig. 6 shows the typical layout for the wiring of a guest floor. It will be noticed that each guest room has a center ceiling fixture controlled from a push-button switch near the door, two bracket lamps, and a wall receptacle and plug for connection with a table lamp. The toilets are provided with two bracket lamps. One of the prominent features of this diagram is its simplicity, every effort being made to run the circuits in straight lines. Taking the upper half of the diagram it is seen that all the ceiling lamps are on one circuit, the conduit being carried from one end of the building to the other, each fixture being controlled by a switch near the door to the room. This one feature does much towards simplifying the wiring as if all the fixtures in one room were connected on one circuit the wiring would become more complicated. The bracket lamps and the wall receptacles are supplied in a somewhat different manner. The two rooms shown to the upper right in the diagram are supplied from one circuit, which also supplies a wall receptacle in the third room which is near the bracket fixtures in the second room. A study of the diagram will show that the same general method of wiring is employed throughout and that this system has the advantages of utilizing a minimum of wire and of simplifying the wiring circuits.

The same policy was employed for corridor lighting, all the fixtures being on one four-wire circuit which is carried around an entire floor.

Among the various lighting features, the illumination of the barber shop and the mezzanine floor are of interest. The barber shop is illuminated by means of a number of semi-indirect fixtures and a number of bracket fixtures over the mirrors. As the floor of the barber shop is of marble, and the walls of white sanitary glazed construction, the illumination of the barber shop is exceptionally well distributed.

The mezzanine-floor wiring is of interest because of the great number of base-board and floor receptacles that

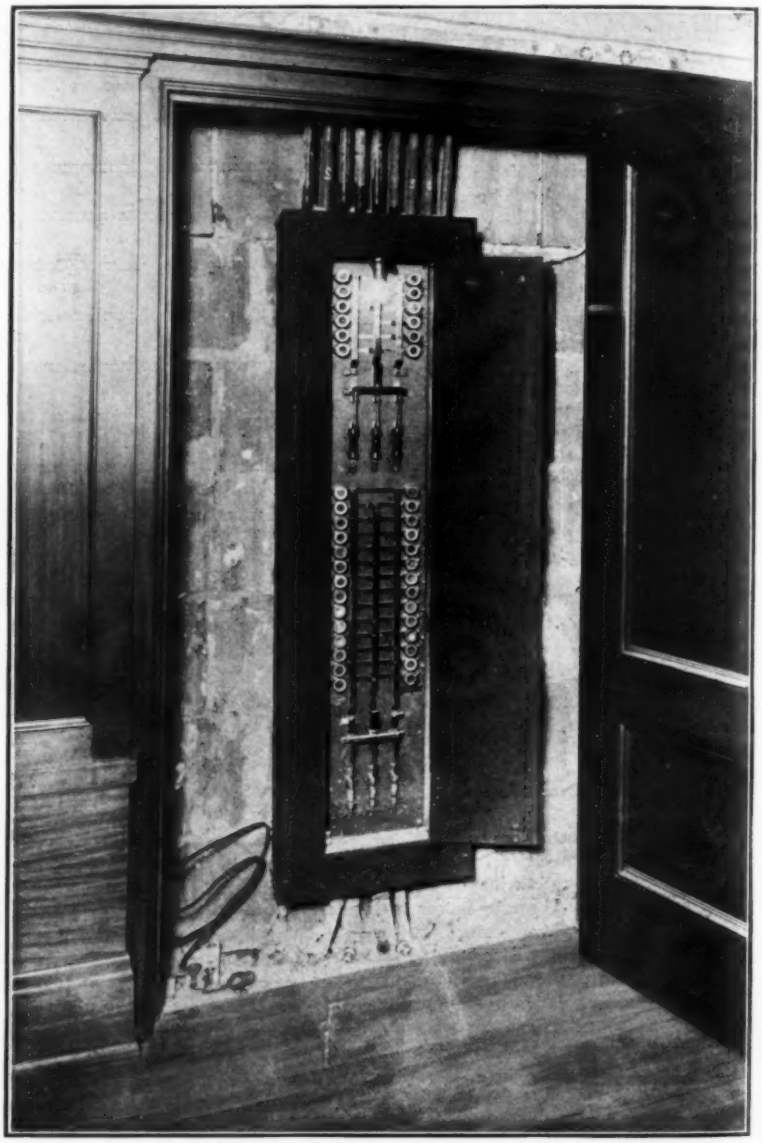


Fig. 7.—Lighting and Telephone Cabinets.

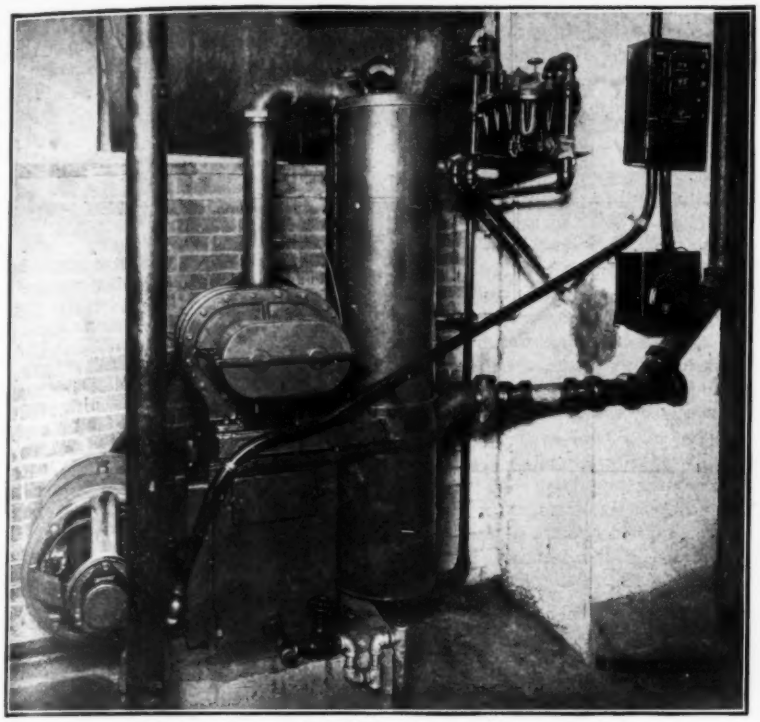


Fig. 8—Conduit Supplying Vacuum-Cleaner Motor.

are provided, making it possible to use numerous table lamps when desired without running long length of unsightly lamp cords.

Proposed City Electrical Licensing Bureau for Newark, N. J.

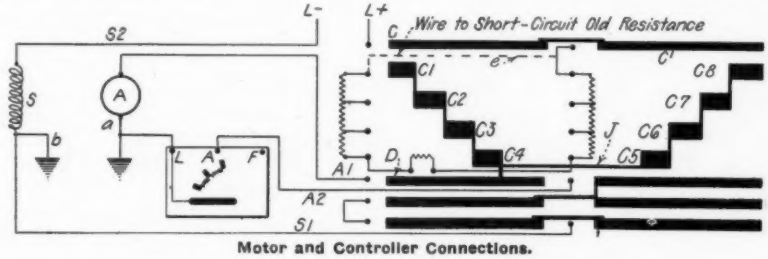
The Master Electricians' Association has submitted an ordinance draft to the Common Council of Newark, N. J., covering the establishment of an electrical bureau. The proposed ordinance provides for the creation of a board of five examiners, empowered to examine all applicants desiring to engage in electrical installation work, including employees of companies as well as individuals who propose to operate independently. No certificate from a city department is to be granted for electrical wiring and other work unless the application is made by a licensed electrician.

A Peculiar Case of Motor Trouble.

The writer was recently called out on a peculiar case of motor trouble. The motor was a two-and-a-half-horsepower series motor operated by a reversing drum controller, which controlled the motor speed through an iron resistance. This resistance had been burned out and the supply house, not having a duplicate set in stock, loaned the firm a starting box for a plain shunt motor, giving directions for connecting temporarily as in the accompanying sketch.

It will be observed that this makes the controller a simple reversing switch, and that the motor should operate satisfactorily upon moving the controller handle to one side or the other and moving the rheostat handle. But after the writer had made the necessary connections, it was discovered that the motor operated only when the controller handle was towards the left. In this position the motor operated at full speed without moving the rheostat handle.

Upon dismantling the motor, it was discovered that one brush holder was grounded at *a* and that the field was grounded near the terminal *b*. The result was that when the controller handle was in the left-hand position, the current took the path, *L* +, *c*, *c'*, *e*, *c*1-4, *d*, *A*1, *A*, *a*, *b*, *S*, *S*2, *L*-; thus cutting out the part of the circuit containing the rheostat. When the controller was reversed and the rheostat handle moved, the current took the path, *L* +, *c'*, *e*, *c*8-5, *d*, *A*2, rheostat, *a*, grounded, *b*, *S*, *S*2, to *L*-. This resulted in cutting the armature out of circuit, and blowing the fuse.



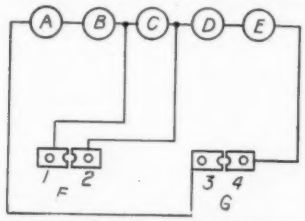
Motor and Controller Connections.

Upon removing these two grounds, the motor operated properly in both directions without changing any connections, and is still operating as well as could be expected under the circumstances. W. R. Smith.

Bank of Lamps for Different Voltages.

In trouble shooting there are several voltages which one may encounter, and a bank of lamps connected as shown in the diagram will be very useful.

For use on a 500-volt circuit the line terminals are connected to the blocks 3 and 4, which puts lamps A, B, C, D and



Lamp and Plug Connections.

E in series. For 220 volts, plugs are inserted at F and G, and the line terminals connected at blocks 2 and 4. For 110 volts both plugs are out and the line terminals are connected at blocks 1 and 2. Lamp C will burn with this connection. All lamps are 110-volt lamps.

A. B. Blatherwick.

Illinois Contractors to Meet at Danville.

The Electrical Contractors' Association of the State of Illinois will hold a meeting at Danville on June 19 and 20. Assistant Secretary E. J. Burns is busy making arrangements for an attractive meeting.

Wireless Plant to be Constructed In Philippines.

In its recent special session the Legislature of the Philippines granted a concession to the Marconi Wireless Telegraph Company of America for the establishing of a wireless plant for long-distance service, especially to Hongkong, Singapore, Shanghai, Japanese ports and other points. The concession runs for 50 years and gives the right to construct a plant for long-distance service only, the service not to be allowed within the islands without further authority.

LETTER TO THE EDITOR.

Indiana Contractors' Meeting.

To the Editor:

I am very sorry to have been misquoted in my remarks before the Electrical Contractors' Association of Indiana in your issue of June 6. I am quoted as saying: "State associations should appoint supply committees whose object should be to forbid supply dealers and contractors from selling small quantities of wiring devices at almost wholesale prices." This is an error on your part because I certainly did not use the word "forbid." What I did say is that we should try to *persuade* supply dealers and others from selling small quantities at wholesale prices.

ERNEST FREEMAN.

Chicago, Ill., June 8, 1914.

Wire-Saving Arrangement for Annunciator.

An annunciator is often installed so as to be rung from a gang of push-buttons at one location. This may be in order that the manager of an office or other official can call any particular person by pressing the appropriate button on the gang switch. In one case an annunciator with 50 points under the word "In" and 50 points under the word "Out" was installed in a large office where a great many heads of departments were frequently coming and going.

On each of the "In" drops was printed a man's name and the list was duplicated on the "Out" drops. Near the entrance door of the office were installed the gang buttons, marked to correspond with the annunciator drops. As each man came in or went out he would push the button marked with his name.

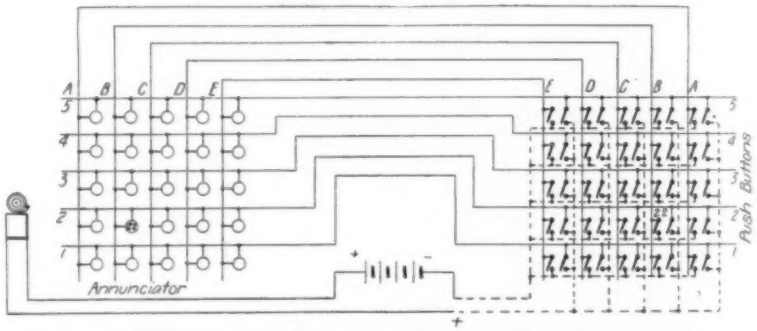
Then in case of a telephone call for any individual it was not necessary for the operator to connect up his private exchange instrument and wait to see if he would answer the ring, but she could simply look at the annunciator and tell at a glance whether he was in or out. Of course at regular intervals she would make a note of who was out and reset the annunciator.

The construction of the floor in the above case would not permit a two-inch conduit to be run from one side of the building to the other, and to save running five three-quarter-inch conduits, which would be necessary to carry the 102 wires as ordinarily connected, an arrangement was used whereby it was only necessary to run 22 wires, which could be accommodated in a single conduit. This resulted in a saving on both labor and material also; although it rendered necessary the use of more complicated and expensive push-button switches.

The arrangement used is indicated in the accompanying illustration, which gives a diagram of connections for a similar scheme using 25 instead of 100 annunciator drops.

The connections on this diagram may be traced as follows, each push-button making two connections: Supposing button No. 22 to be depressed, current will flow from the battery through the annunciator bell, along the positive dotted bus, through one side of the push-button switch to wire 2, through drop 22 on the annunciator to wire *B*, back through the other side of the push-button to the negative dotted bus and thence to the battery.

Any one of the 25 buttons indicated may be pushed and in the same manner will indicate upon the corresponding annunciator drop. In the case shown in the diagram 12 wires only are necessary to operate 25 drops. The advantage in number of necessary wires increases as the number of annunciator drops goes up, and in the case of the 100-drop installation referred to, only 22 wires were necessary. The batteries may be placed at either the annunciator or the push-button end of the line.



Wiring of Annunciator With Push Buttons and Annunciator Drops Concentrated at Two Points.

Any commercial annunciator can be changed over to fit this scheme. The buttons should be arranged with small busbars in the back, insulated from one another with fiber bushings, and each bar tapped for a 6-32 screw directly back of the buttons.

The front and back of the gang should be of solid brass plate and the front drilled to receive double-pole midget buttons. The back should be removable in order to permit the connecting up of the buttons. The frame of the gang may be of hardwood molding finished to match the furniture of the room.

Each button should first have four short wires connected to it. It is then pushed through one of the holes in the plate and is connected to the proper busbars from the rear.

B. H. Fisher.

Among the Contractors.

The Capitol Electric Company, of Des Moines, Iowa, has the contract for the wiring installation in the new Y. M. C. A. building in Marshalltown, and also for the new public school at Sheffield, Iowa.

The Inland Electric Company, which was recently established at 412 Hubbell Building, Des Moines, Iowa, has the contracts for the electrical work in the new addition to the North High School in Des Moines and for the Church of the Immaculate Conception at Cedar Rapids. This company is also completing the electrical work in the new Wenks & McCune Building in Des Moines.

Through Dawson & Holbrook, architects for Horace Chapman, Columbus, O., the Ryan Electric Company, of that city, has secured the wiring and conduit work in the remodeling of a six-story building into a power building. A feed wire carrying 300 horsepower will be introduced. The contract amounts to about $1,100. Bids for the motors and installation of same will be called for at a later date by the architects. The Ryan Electric Company has also secured an $800 contract for the wiring of the new high school at Pomeroy, O.

Paul H. Jaehnig, Newark, N. J., has been awarded the contract for electrical work in the new Lafayette Street School to be erected by the Board of Education of Newark. The Newark Gas & Electric Fixture Company has been awarded the contract for lighting fixtures.

The electrical work at the new Stivers School in Dayton, O., has been awarded to the William Hall Electric Company.

Walter Coleman, Jersey City, N. J., has been awarded the contract for electrical work in the new school building to be erected at St. Paul's Avenue and the Boulevard.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Western States Gas & Electric Company was authorized to issue two promissory notes, one for the sum of $108,900 and the other for $232,100.

The Calistoga Electric Company was granted a certificate of public convenience and necessity to operate under a franchise granted by Napa County.

ILLINOIS.

The Milford Telephone Company has applied to the Commission for a certificate of convenience and necessity to extend its telephone system into the territory now occupied and served by the Hickman Illinois Telephone Exchange.

KANSAS.

Berryton Telephone Company. In a decision rendered on May 22, the Commission has held that no public utility can have two different rates for the same class of service to different patrons. Relating to the Berryton Telephone Company, the opinion states that "It is very evident that this company, like many others, originally was organized nd intended to be operated as a purely mutual company. However, its experience is that the demand for service grew until it became a public utility operated for profit."

Northeast Kansas Mutual Telephone Company et al. The Commission has held that telephone companies must provide service for competing companies when it is shown that such service will accommodate the public. The Northeast Kansas Mutual Telephone Company, the Morrill Mutual Telephone Company and the Robinson Mutual Telephone Company were ordered to furnish service to a competitor, the Hiawatha Telephone Company, and the Commission stated that a company may be required to install a telephone in the office of a competing company at regular rates in order that patrons may be notified of calls over the other line.

MARYLAND.

United Railways & Electric Company. The Commission ordered the company to make an extension of its line from Overlea to Jerusalem. The company appealed and the Circuit Court No. 2 handed down a decision, June 2, holding that the demands of the Commission are unreasonable. The court sustained the company's contention that the service was not required in order to properly serve the public and that the expense would be considerable and that the extension would not pay for a number of years. An injunction was granted suspending the operation of the Commission's order. The opinion of the court cites the case of Laird vs. the B. & O. R. R., 121 Md. 187, as follows: "The discretion of a public service commission cannot override the discretion of the officers of the corporation in the management of its affairs, or the provisions of the statute in which securities are permitted to be issued."

NEW HAMPSHIRE.

Standards of Service. Rules prescribing standards for electric service, and providing for the testing of meters and otherwise regulating the service of electric utilities were adopted May 27th by the Public Service Commission. These rules are to apply to each electrical utility serving the public which in any one year shall have generated, transmitted or sold more than 25,000 kilowatt-hours or shall have more than 25 consumers. These rules are to go into effect July 1, 1914. It appears that it was the aim of the Commission to prescribe regulations adapted to the needs and the present state of development of the utilities to be affected. The Commission calls attention to the rule on voltage variation and states that the fluctuation in voltage permitted may appear to be excessive "but in view of the conditions existing in many parts of the state, a more exacting requirement at this time might work an undue hardship upon some of the utilities. A closer regulation may be expected to be practical in the future. It may be that some utilities cannot immediately meet the requirements of the rule as now made, since such requirements may involve the redesign and reconstruction of distribution systems, or the installation of regulating devices. In any such application may be made to the Commission for a temporary suspension, or a modification of the rule to meet the reasonable requirements of the particular situation, and in such case the Commission will make investigation and will take such action as may be in fact reasonably necessary."

NEW YORK.

New York Telephone Company. The Public Service Commission of the Second District has found it necessary to appoint a special counsel in connection with the investigation of the rates of the New York Telephone Company in New York City. D. B. Murphy, of Buffalo, has been engaged for this work on a month-to-month contract for not to exceed six months. It has been estimated that three hundred men could not complete the inventory and appraisal in much less than a year and effort is being made by the Commission to devise some plan which will shorten the time required and still provide a proper basis for rate making.

OHIO.

The Cleveland Telephone Company was granted authority to issue $4,000,000 of 5 per cent two-year notes. More than $3,000,000 of the proceeds will be used for refunding previous bond issues and the balance for improvements.

Uniform Accounts. Karl B. Nau, of Cleveland, has been employed by the Commission to prepare systems of accounting for utilities and submit them to the Commission for consideration. Representatives of the companies have been invited to confer with the Commission in this matter.

PENNSYLVANIA.

Discrimination Justified. The Commission dismissed the complaint alleging discrimination in the case of C. S. Goerlich et al. vs. Bethlehem City Water Company. In 1913 the borough of Bethlehem extended the mains of the municipal water plant to serve a certain district in West Bethlehem in competition with the respondent company. The latter, as a matter of self protection and in order to meet competition, made a discount of fifteen per cent for prompt payment to consumers along the streets occupied by its competitor. This discount provision was not extended to any of the company's consumers outside of this district. The contention was made by the com-

plainants that this discount allowed to consumers in one street and not to those in a nearby street constituted a discrimination within the prohibition of the public service commission law. In passing upon the question as to what constitutes discrimination, the Commission says: "The question raised under the facts so found is whether or not the additional discount allowed to certain consumers and not to all is such a discrimination as the act of 1913 was intended to prevent. There is much of merit in the position of the respondent. It has invested large sums in its plant and has for thirty years at least supplied the people with a necessity of life without any return made to its stockholders. It now finds the territory it had occupied invaded and its rates presumed to be reasonable, in the absence of evidence to the contrary, assailed. It will be observed that the greater or lesser compensation forbidden by the act of 1913 is that of a charge 'for a like and contemporaneous service under substantially similar circumstances and conditions.' While it is manifestly the purpose of the act that public service companies should be supervised and controlled, and that everything in their conduct unreasonable or unfair should be prevented, there is nothing to indicate any intention to destroy or interfere with vested interests or to hamper the proper exercise of the powers conferred upon such companies.

"In the present case with respect to the streets to whose residents the greater discount was allowed by the respondent, there was competition of a serious character. To these residents another supply was offered at lower rates. The undisputed testimony is that it was necessary 'to meet their rates or lose the business entirely.' To lose the business would be to render valueless the investment in that part of the plant. The competition was the more threatening because of the fact that it had the strength and power of the municipality to support it. As to what constitutes such competition as will create a dissimilarity of circumstances and conditions must be determined from the facts of each case as it arises. After giving careful consideration to the ascertained facts and the situation as it exists in West Bethlehem, it is our conclusion that such dissimilarity between the conditions upon the streets named and the others exists as to make the prohibition of the statute inapplicable. It follows that the complaint should be dismissed and it will be so ordered."

The Economy Stock Telephone Company. The Commission has issued a decision ordering that the telephone company shall make no difference in the rates which it charges stockholders and non-stockholders and requiring that the practice of furnishing and maintaining free telephone service in hotels and railway stations be discontinued. The case arose upon the complaint of the Somerset Telephone Company, pointing out that discriminatory rates were charged by the Economy Company.

WISCONSIN.

Physical Connection of Telephone Lines. The Commission ordered that physical connection be made between the Wisconsin Telephone Company and the Rock County Telephone Company of Janesville for toll, local and rural service.

INTERSTATE COMMERCE COMMISSION.

The United States Supreme Court rendered a decision, June 8, upholding the order of the Interstate Commerce Commission in the Shreveport Rate case. The Louisiana Railroad Commission complained to the Interstate Commerce Commission that certain class rates applying from Shreveport to Texas points were unjustly discriminatory. Lower rates for similar shipments arising from Texas towns over the border were lower as prescribed in an order of the Texas Railroad Commission. The Interstate Commerce Commission ordered the railroad companies involved to eliminate the difference in these rates. In reviewing this order the court holds that Congress had power to control interstate charges of an interstate carrier to the extent necessary to prevent injurious discriminations against interstate traffic and that this power has been conferred by Congress upon the Interstate Commerce Commission. The court says: "It is of the essence of the power to regulate interstate commerce that where it exists, it dominates. The fact that carriers are instruments of intrastate commerce as well as of interstate commerce, does not derogate from the complete and paramount authority of Congress over the latter or preclude the federal power from being exerted to prevent the intrastate operations of such carriers from being made a means of injury to that which has been confided to federal care. Wherever the interstate and intrastate transactions of carriers are so related that the government of the one involves the control of the other, it is Congress and not that state that is entitled to prescribe the final and dominant rule, for otherwise Congress would be denied the exercise of its constitutional authority and the state, and not the nation, would be supreme within the national field."

BOOK REVIEWS.

"How to Build Up Furnace Efficiency." By Joseph W. Hays. Seventh edition, revised and enlarged. Chicago: Joseph W. Hays. Paper, 126 pages (4½x7¼ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.00.

This volume should be of interest to the plant owner, the manager and the fireman, and is written so that any one of these can understand what the author is driving at, as he has taken care not to make it too technical. The great waste of fuel under prevalent furnace practice, especially as it is found outside of the central stations, is strongly emphasized, and means indicated for rectifying inefficient conditions. While most of the information given is not new to the trained engineer, it should be very helpful to the classes of readers above mentioned, and if the author's directions are carried out in power plants which have heretofore paid little attention to fuel economy, the result should be very beneficial.

"The Practical Telephone Handbook and Guide to the Telephone Exchange." By J. Poole. Fifth edition, revised and enlarged. London: Whittaker & Company. Cloth, 624 pages (5x7½ inches), 535 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $2.00.

The text of this book is a comprehensive popular handbook on the telephone and is evidently particularly written for telephone wiremen and others interested in the practical end of telephone construction and operation. It describes with considerable detail instruments and other apparatus used by subscribers, in exchanges, substations, power plants, lines. etc. The first few chapters are devoted to a popular explanation of electrical principles, while other chapters are devoted to electrical measurements and the testing of telephone systems. Submarine telephone cable systems and wireless telephony are briefly considered. Very little space is devoted to multiplex telephony and no attempt is made to discuss theoretically the many troubles associated with telephony. The book, however, should prove useful to the practical telephone man. The chapter on automatic telephony has been rewritten in this edition, and additions have been made to a number of other chapters.

Gas-Filled Tungsten Street Lamps for Newark.

The Board of Works of Newark, N. J., has entered into a five-year street-lighting contract with the Public Service Electric Company. The agreement provides for the installation of 200 new nitrogen-filled tungsten lamps at once, and 500 additional such lamps within a year.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 218.—Panama Canal Locomotives.—What reasons were considered for adopting the very low potential of 220 volts for the towing locomotives for the Panama Canal? Why was three-phase current chosen instead of direct current, which has many advantages as long as high voltage was not to be employed? Why are two very heavy and costly copper "third" rails used as contact lines? Why is the rack-rail construction such a one as to take hold of the rack pinion?—A. G., Wilkinsburg, Pa.

No. 223.—Street or Station Indicator.—Is there on the market an automatic device, usable inside of street cars, that will automatically, through electrically illuminated signs in each end or one end of the car, indicate intersecting streets by name as and when the car approaches such intersecting streets, irrespective of the number of such streets, and is the same practicable? Where is such a device used and by whom manufactured?—W. H. W., Kansas City, Mo.

No. 224.—Alternating-Current Machines.—(A) In connecting a two-phase or three-phase alternating-current generator to a switchboard to which several other machines of the same kind are already connected, what methods may be used to insure getting the new machine in the proper phase relation to the busbars? (B) What is the purpose of the synchronizing resistance connected across the collector rings of a rotary converter while starting from the direct-current end?—P. M. B., Hudson, Ill.

No. 225.—Blame for Faulty Connection.—A certain building was wired and pronounced O. K. by the inspector. After meter was installed (it was a three-wire job) the lamps connected to the switches on the left side of the switchboard burned out. A test showed that the neutral wire had been connected to the right-hand pole of the entrance switch instead of to the center pole, thus giving 220 volts on the left and 110 on the right. The meter man supposed that the neutral was in the center and, as there was nothing to indicate the contrary, ran the two outside wires through the meter and onto the switchboard, as is customary. The entrance wires came in through conduit and could not be traced to the outside connections. The owners of the building blame the meter man; we contend that he was not at fault. Who is right?—J. S., New Knoxville, O.

No. 226.—Rewinding Motor.—How can I change a bipolar, 110-volt, direct-current, 250-revolutions-per-minute, series fan motor into a generator giving 10 to 20 volts and about 20 amperes? At present there is wound on each field one-half pound of No. 27 single cotton-covered wire; the armature has 12 slots and 12 bars and 120 turns of No. 30 double silk-covered magnet wire in each slot. I have two machines like this, exactly alike, and wish to make a motor-generator of them by changing one as indicated above.—H. J. G. J., New York City.

Answers.

No. 221.—Quartz Lamps on Alternating-Current Circuits—Why can the ordinary quartz-tube lamp not be used on alternating-current circuits? Are any such lamps available for these circuits?—B. W., Denver, Colo.

While it perhaps is feasible to build quartz lamps for alternating-current circuits, it is as yet considered to be commercially impracticable to do so, chiefly on account of likelihood of electrode trouble which is absent on direct current. Quartz lamps can, however, be operated from alternating-current supply circuits by using in connection therewith a mercury-arc rectifier. Many lamps have been installed in this manner, a rectifier serving from one to three quartz lamps in multiple.—K. L., Chicago.

No. 222.—Induction Motors.—1. With a given set of coils and a three-phase induction-motor stator, is there any rule by which the proper coil pitch can be determined other than approximating by placing the coil in the slots? 2. What effect on the power-factor, efficiency and speed will changing the coil pitch give on induction motors? 3. With a given winding in an induction-motor stator, what effect on power-factor and efficiency will changing the connections from Y to delta have and vice-versa?—A. C. H., Security, Md.

1. To determine the proper coil pitch for an induction motor, find out from the name plate the number of poles. If this is not given get the speed at which it operates and the frequency of the circuit to which it is to be connected, then from the formula $P = 120\ F/R.\ P.\ M.$, where P is the number of poles and F the frequency, the number of poles can be obtained. The coil pitch equals the number of slots divided by the number of poles. 2. In order to have a symmetrical winding in an induction motor it is necessary that the number of coils be a multiple of the number of poles and the number of phases. If the coil pitch is changed enough to make the above hold true, the speed will change according to the formula in the first part of the answer. If the speed increases the efficiency and power-factor will both increase, if proper change is made in the coil windings. If the speed decreases both will be lower. If the winding is not symmetrical it is not possible to give a general answer as to the performance.

3. If the winding of a given induction motor has been changed from star to delta and the voltage of the circuit on which it is operating is left the same, the condition is equivalent to operating the motor on a circuit the voltage of which is 1.73 times the original voltage of the motor. In addition there is likely to be heating due to the third harmonic which is likely to cause trouble in almost any delta-connected motor. If the change is made from delta to star, it is equivalent to operating on a voltage of 58 per cent of normal.—J. H. M., San Francisco, Cal.

Dayton Manufacturers Co-operate With Continuation School.

The Apple Electric Company, of Dayton, O., is one of a group of a dozen large manufacturers in that city, including the National Cash Register Company, which has entered into a plan under which, by co-operation with the Y. M. C. A., they have encouraged a continuation school for the benefit of their younger employees, conducted by the organization referred to. Boys employed in the plants of the manufacturers participating in the plan are permitted to attend the Association school for one-half a day each week without loss of pay. The course covers four years and instruction is included on the subjects of shop theory, mechanical drawing, and similar matters, which are calculated to be of practical benefit to the students. The second annual banquet of the school, marking the completion of its second school year in operation, was held recently, 130 persons being present, including representatives of the manufacturers, plant foremen and superintendents and the boys who are taking the course.

Central-Station Progress in Calcutta, India.

The electric supply company which operates in Calcutta, India, is progressing so rapidly that a further $2,500,000 capital has to be raised for new equipment to cope with the demand for light, fans and power. A large saving is being experienced consequent upon the installation of more economical plant, the closing down of the four old generating stations, and the concentration of all generation at the Cossipore new power station. The net revenue has nearly doubled in five years and a low-price demand from Calcutta's manufacturing industries is anticipated. The capital will now stand at $7,500,000. The dividend just paid has been nine per cent per annum, and as an incentive to co-operation and in order to keep down costs, a bonus system has been introduced under which one per cent of the net profits is divided among the staff in proportion to their salaries.

RELATIVE ADVANTAGES OF STAR AND DELTA CONNECTIONS.

Meeting of American Institute of Electrical Engineers at Pittsfield.

The 296th meeting of the American Institute of Electrical Engineers was held at Pittsfield, Mass., on May 28 and 29, under the auspices of the Pittsfield Section. Headquarters were at the Maplewood Hotel. The general subject for discussion was "Relative Advantages of Star and Delta Connections."

The first session was held on Thursday afternoon and was called to order by W. W. Lewis, vice-chairman of the Pittsfield Section. After extending a welcome to those present he called upon Past-President Dugald C. Jackson to preside. The first paper to be presented was one by D. W. Roper, of the Commonwealth Edison Company, Chicago, entitled "Experiences with Line Transformers."

Experiences With Line Transformers.

This paper present an analysis of the transformer troubles for one year on the system of the Commonwealth Edison Company, Chicago, which has nearly 15,000 transformers installed. About 50 per cent of the troubles due to the transformer can be eliminated without great expense by slight changes in construction details and methods of operation. The Bureau of Standards specification for transformers is taken to represent average American practice and is discussed with reference to improving some of the details in present practice. The name plate should be so placed that linemen can easily inspect it. Cases should be provided with handles so as to avoid the use of leads for this purpose. The leads should be provided with terminals just outside of the porcelain bushing. It would be preferable to buy cutouts and oil separately, and specifications for a cutout are given. Connection boards should be submerged, as 60 per cent of the troubles are due to lightning jumping across this board when it is above the oil. The records of four different makes of transformers are used as a basis for discussion of the value of continuity of service. It is shown that cost of repairs is a comparatively minor item and that a high value must be placed on continuity of service in order that the savings due to the most reliable transformer may offset the cost of its increased losses. Results of experiments with improved lightning protection are given, showing how the troubles were reduced to one-third. It is preferable to put lightning arresters on each pole carrying a transformer. Primary fuses should be used to protect the rest of the service from a defective transformer and not to protect the transformer itself from overloads. With proper attention to lightning arresters and other details of the transformers, cases of trouble due to lightning should be reduced to 10 or 20 per cent of those formerly experienced.

The discussion was opened by W. S. Moody, who, on behalf of the manufacturers, welcomed the information given by Mr. Roper as to the experience of the users of transformers. Co-operation between manufacturers and users is necessary to get the best results and to determine just how much expense is warranted in securing reliability. Pressure is brought to bear upon the manufacturer and the user to decrease the weight, size, cost, etc., to accede to which reduces the factor of safety, so that there is not much danger of transformers being made too reliable.

A. D. Fishel said that the distributing transformer is one of the most reliable as well as one of the most important things in a large distribution system. Transformers have been greatly improved in recent years and the reliability has been increased and more attention will be given in the future to their proper protection. The tables in Mr. Roper's paper apply to transformers that have been turned out in the past and not to the particular designs which are at present available. With present designs a connection board can be operated with perfect safety at the oil level. Larger clearances are allowed and syphoning of oil is avoided. This board is an advantage in giving support to the leads between the coil and the outlet bushing. For voltages of 6,600 or higher, the connection board should not be at the oil level. He advocated the standardization of voltages so that a connnection board would be unnecessary and taps could be eliminated. In that case the leads could be supported by porcelain spacers. Many transformers now have lifting lugs cast at the side of the case, avoiding the temptation to use the lead wires for that purpose. Nevertheless, with the rugged primary bushings which are now used and other changes it is hard to injure the transformer through the mishandling of the leads. More reliable fuse blocks are now available.

H. W. Hough, of Cleveland, O., said that his experience had been similar to that of Mr. Roper. Of 10,000 transformers in service, 400 had been damaged during the year. In most cases the terminal boards were damaged, except where they were submerged in oil.

Paul M. Lincoln questioned whether the evidence warranted the conclusion that the submergence of the connection board is a desirable thing. Burnouts are less frequent when a lightning arrester is on the same pole as the transformer. When a lightning arrester is not present the terminal board inside may serve the same purpose, as it is a relatively weak point. The records demonstrated that the connection board should have sufficient clearance to make it improbable that the lightning will jump across inside. This would remove any objection to the connection board. He agreed with Mr. Roper that transformer fuses should be installed for the purpose of interrupting short-circuits, etc., but not for protection against overload. The accelerated life test would be desirable, but so far no way has been devised to accomplish that result.

Joseph Franz, of Lenox, Mass., said that similar troubles had been experienced there as in Chicago. It is not always possible to obtain a good ground for a lightning arrester and when these are connected to the same ground as the secondaries, trouble has been caused by failure of the lightning arrester, which fused across the gap and sent primary current into buildings, which have been set on fire. He thought it would be an advantage for manufacturers to standardize the form of name-plate. He thought it preferable for the manufacturers to furnish oil with transformers.

M. O. Troy agreed with Mr. Fishel in urging standardization of primary and secondary voltages, so that the connection board could be entirely omitted. If the connection board is retained, he favored the submerged board.

E. E. F. Creighton said that deterioration due to successive strains has been determined by accelerated life tests. Such surges as are produced by lightning, with high frequency, high potential, steep wave fronts or sloping wave fronts can be used and it has been found that there is a deterioration from successive discharges. The number of discharges that the insulation of a transformer will stand is dependent upon the variety of the discharge, that is upon the voltage and the steepness of the wave front. Some of the salient points brought out are as follows. Doing away with exposed terminals reduces the troubles by one-half; placing arresters on the same pole with the transformers has further reduced the trouble to one-third; and improvements in protection again decreases the troubles to one-half. Combined they reduce the trouble to one-twelfth. Since the total trouble was originally small, this makes the effect of lightning quite negligible. This investigation has shown how to choose the elements in an arrester to give the highest degree of protection. Where a terminal board is arranged so as to allow a minimum discharge to take place through the case the transformer is not protected, but actually damaged. Mr. Roper's results show that one-third more transformers were damaged where the terminals were exposed than where they were not exposed. He summarized the situation relating to the practice for protection against lightning as follows: (1) Have no exposed terminal boards; (2) Place the arrester on the same pole with the transformer, but separate grounds should be used for the lightning arrester and the secondary circuit; (3) Use an arrester with good protective

qualities; (4) Ground the transformer case to the ground terminal of the arrester, especially if the secondary is not grounded.

H. B. Alverson, Buffalo, N. Y., said it is very evident that the transformer ought not to be a lightning arrester. To put lightning arresters on the same pole with transformers is sometimes difficult in cities where there is joint use of poles. A number of lightning arresters on a circuit make it harder to locate trouble. A limited number of lightning arresters properly placed will do more good than a large number.

W. L. Granger, of Detroit, Mich., said that transformer connections were standardized in that city and terminal boards had been removed. It made little difference what the dimensions of the connection board were when it is at the oil level, because smoke, soot and moisture were breathed into the transformer and collected on the board. He agreed there should be a lightning arrester for each transformer. It was advisable to insert a fuse consisting of a piece of No. 18 copper wire inside of a glass tube on the line side of the lightning arrester. This prevented a breakdown in service in case the lightning arrester short-circuits. He uses these with all multigap arresters.

W. J. Wooldridge said three points should be considered in obtaining reliability of transformers: (1) design; (2) manufacture; (3) insulation and protection of installed apparatus. In designing insulation a certain margin of safety must be allowed for possible accidents and it is important that the material be properly handled by the workmen. The latter can best be secured by co-operation and teaching the workmen to understand the necessity of "safety first," both in their own shop and in the output which is to be turned over to others. He exhibited curves showing how the percentage of accidents had been reduced in the Pittsfield works of the General Electric Company. A monthly printed paper is distributed among the workmen giving information as to the value of perfect insulation, etc. He read an extract from one of these bulletins showing the connection between insulation and safety and winding up with the admonition: "Be careful with all insulation."

In closing the discussion, Mr. Roper admitted that conditions could be improved by better design of connection board, but it is preferable to remove the board altogether in the case of companies which operate at a single definite voltage. In Chicago all boards are removed from new transformers, and old transformers receive the same treatment when they come in for repairs. The use of joint poles is customary in Chicago, but lightning arresters are always installed on same pole with the transformer and grounded at that pole, and the secondary is grounded on a different pole. Where the telephone company already has a ground upon a pole which it is desired to use for mounting a transformer, the telephone company is paid for the cost of removing its ground to the next pole. Increasing the number of lightning arresters does not seem to increase the trouble as most types of arresters now in use give comparatively few interruptions to service. They are almost as reliable as the transformers themselves. He had tried the practice of grounding transformer cases and experience is being collected on this point. From 600 transformers so far no particlar difference has been noticed. An arrester on each transformer is not necessary but contributes to more reliable service.

The next two papers were discussed together. The first of these, by R. W. Sorenson and Walter L. Newton, entitled "Inherent Voltage Relations in Star and Delta Connections" was, in the absence of the authors, presented by H. W. Tobey. The second paper was by R. C. Clinker and was entitled "Harmonic Voltages and Currents in Star and Delta-Connected Transformers." It was presented by H. O. Stephens.

Inherent Voltage Relations in Star and Delta Connections.

The paper gives the results of experiments made with a miniature simple transmission system to demonstrate the inherent voltage relations with different combinations of star and delta connections. The experimental system consisted of a 7.5-kilowatt revolving-field generator, with coil terminals which could be connected either star or delta, and two banks of transformers each composed of three shell-type 3-kilowatt units. All inductive and capacity effects in the transmission line were eliminated. The tests were made under constant conditions, with non-inductive load. The authors give the results of four groups of tests, on four different systems of connections, pointing out the advantages and disadvantages of the several systems. In each case tests were made without load, with balanced load, and with load on one phase only, for various conditions of grounding. Typical voltage diagrams are given, to show what happens under various conditions of load. From these data the following conclusions for a star-connected transmission line are drawn. The generator should be star-connected. The neutral point should be well grounded at both ends to relieve electrostatic strains. There is, of course, the objection to a grounded neutral, that if a line becomes grounded also, one phase is short-circuited. The second point, which fortunately does not often arise in practise, is that all alternator frames, motor frames, and transformer cases should be thoroughly grounded, not only for the foregoing considerations, but also to protect the lives of operators and linemen. The disadvantages of star-connected transmission lines are the difficulty of obtaining a satisfactory ground on the neutral and overload or short-circuit of one phase by partial or complete grounding of a line. The authors discuss certain cases where the use of auto-transformers is advantageous, and the effects of different ways of connecting them.

Harmonic Voltages and Currents in Transformers.

This paper reviews the conditions under which triple-harmonic voltages and currents are produced in star and delta-connected transformers. These voltages are produced by hysteresis in the core. In a single-phase transformer, increase of series resistance tends to suppress the current harmonic and produce the voltage harmonic. In three-phase transformers, a star connection suppresses the current harmonic and allows the full flux and voltage harmonics to appear. Delta connection provides a closed path for the current harmonic, and suppresses the triple voltage. A case is cited where a star-connected autotransformer was used to step up from 6,600 to 12,000 volts at a substation. The neutral was not grounded, and trouble resulted due to partial resonance at triple frequency between line capacity and transformer reactance. The paper shows that, although not generally recognized, a triple component can exist in the line-to-line electromotive-force waves of a three-phase system. This is possible in a case where a two-to-three-phase transformation is used, and when the electromotive-force wave of the two-phase generator contains a triple harmonic. Vector diagrams and curves are given illustrating this possible effect.

Secretary G. W. Wade opened the discussion by reading two written contributions. The first was by Waldo V. Lyon and called attention to the fact that the writer had observed the possibility of the third harmonic referred to by Mr. Clinker, in connection with the Scott transformer connections. The second communication was from A. E. Kennelly and Harold Pender and told of the observation of a considerable voltage rise upon an artificial transmission line constructed at the Massachusetts Institute of Technology, which was equivalent to a 500,000-circular-mil three-phase conductor system 240 miles long.

Mr. Tobey, in presenting the paper, called attention to the fact that the apparatus used by the authors was comparatively small and that the results obtained might not be duplicated on a large high-voltage system.

F. W. Peek, Jr., discussed the conditions under which a third-harmonic may exist. If the third harmonic component of the magnetizing current is suppressed, as it may be when autotransformers are connected in star, the voltage wave will be peaked, hence in transmission work, especially where autotransformers are used, and in connec-

tions in which the third harmonic may be suppressed, care should be taken to avoid this. One of the simplest ways is to connect the neutrals of the transformer and generator together. It should be observed that instruments which measure effective values will not show the existence of such peaks.

Louis F. Blume pointed out that it is not only in Scott-connected transformers that the third harmonic may appear in a three-phase system, but that the generator itself might be connected in the same manner so as to make it prominent.

F. C. Green stated that he had been connected with the system referred to by Messrs. Sorenson and Newton, and told of some of the tests which have been made on that system. There is no excuse for having triple frequency in a system, because it is now known how to eliminate it.

C. L. Fortescue stated that the conclusions of Messrs. Sorenson and Newton were not warranted by the data given. He also disagreed with the statement that there was no manufacturing advantage in the star connection as compared with delta. The peculiarity of the Scott connection in bringing out the third harmonic, mentioned in Mr. Clinker's paper, had been noticed before and the same thing might occur in any connection which introduced dissymmetry of the phases.

Paul M. Lincoln stated that the same thing had been observed 19 years ago, when studying the wave forms of the Niagara Falls generators, which were of the two-phase type with flat waves. When they were connected up by the Scott method for three-phase operation, the wave form of one phase was unchanged; whereas, the other two were distorted in opposite directions.

J. M. Weed pointed out that Mr. Clinker had attributed the third harmonic to the effect of hysteresis, whereas it is really due to the variation of permeability.

Professor Jackson gave some particulars of the artificial transmission line used by Dr. Kennedy and Pender.

The session on Friday morning was called to order by President-elect Paul M. Lincoln. The first paper to be presented was one by Louis F. Blume, entitled "The Influence of Transformer Connections on Operation."

Influence of Transformer Connections of Operation.

In this paper the relative advantages and disadvantages in operation of the more important three-phase transformer connections are discussed. Three conditions of operation are given: (1) normal; (2) operation of a bank with one phase disabled; (3) effect of line grounds on operation. The paper is not complete, particularly in that high-frequency or switching phenomena are not discussed. Its major purpose is to give a fairly adequate presentation of insulation stresses at relatively low frequencies to which transformers are subject in either normal or abnormal conditions of operations. These frequencies include the fundamental or generated frequency and its harmonics and the natural frequency of the system. The behavior of three-phase autotransformers under the various conditions of operation given above is also analyzed. The following conclusions are reached. (1) Isolated systems are subject to greater insulation stresses than grounded systems and hence the latter have higher factor of safety. (2) A ground on an isolated system is more likely to be an arcing ground. (3) A ground on grounded system reduces potential of system, while on isolated system it increases potential. (4) Resistance in ground connection increases insulation stresses. (5) Neutrals must be grounded at both generator and end of line to limit potential to 57 per cent of line voltage. (6) With star-connected autotransformers, an isolated neutral is dangerous unless entire system is insulated, ratio of transformers is small, and triple-harmonic voltage is eliminated.

C. L. Fortescue then presented a paper entitled "A Study of Some Three-Phase Systems."

A Study of Some Three-Phase Systems.

The star-star, delta-delta, delta-star and star-delta connections are taken up in order and their individual peculiarities and characteristics, precautions that must be taken in operation to avoid trouble and where and when the system may be grounded with best results, are discussed. The question of delta-delta versus delta-star is considered. (1) For moderate voltages the delta-delta system has the advantage on account of its greater flexibility. (2) Above 44,000 volts the delta-star connection is preferable, chiefly on account of its greater strength and lower cost. There is a probability that a delta-star bank of transformers will cause less disturbance in switching than one that is delta-delta connected. (3) There are much greater possibilities of development in transformers designed for delta-star connection than for any other. (4) Past and present practice upholds the use of the delta-star connection in preference to the delta-delta for high-voltage transmission.

These two papers were discussed in conjunction with a third one by J. P. Jollyman, P. M. Downing and F. G. Baum, entitled "Experience of the Pacific Gas & Electric Company with the Grounded Neutral." In the absence of the authors this paper was presented by V. M. Montsinger.

Experience of the Pacific Gas and Electric Company With the Grounded Neutral.

The paper gives an outline of the distributing system of the Pacific Gas and Electric Company, which operates at 60 kilovolts, the transformers being star-connected, with the neutrals solidly grounded. The company considers the grounded-neutral system has a number of important advantages with regard to the transformers, the transmission lines, and operation. The fewer turns of larger capacity of the star-connected transformers and the fixed lower average voltage to ground greatly increases their reliability. The maximum voltage on the line insulators with the grounded neutral is never more than 57.7 per cent of the line voltage, and it is possible to maintain polyphase service at a substation on a branch line with only two wires in case one wire should be cut out. This cannot be done on a delta system unless one phase of the system be grounded, which is very undesirable. With a grounded neutral, a wire down is instantly detected and power must be shut off. In a delta-connected system an arcing ground is often followed by surges which break down the insulation at other points, the cause of this disturbance being the oscillatory character of the arc. In the grounded-star system no such disturbances occur, as the frequency of an arc to ground is the same as that of the system and any damage is confined to the point of failure. It is also believed that operation with the grounded neutral causes less disturbance in telephone and telegraph lines than would be the case in delta-connected lines.

F. F. Brand opened the discussion by reading a communication from Guido Semenza, Milan, Italy. Italy, with an area about double that of the state of New York, has more than 2,400 hydroelectric power plants, nearly all of which are connected with transmission and distribution lines. The output varies from a few thousand up to 40,000 kilowatts, and the transmission voltages range from 6,000 to 88,000 for overhead lines, and up to 25,000 volts for underground lines. Most of the systems are delta connected and insulated from the ground. A few have horn-gap arresters between the neutral point and ground. A few have the neutral point grounded through a resistance. There are two which have the neutral point grounded without resistance. None of the underground lines has a grounded neutral. On the low-tension distribution circuits all of the usual arrangements are to be found. The isolated-delta connection was the first to be used in Italy, and as its operation has usually been satisfactory there has been little tendency to change. In some of the later installations, however, upon which there were disturbances, the neutral was grounded as an experiment both in the power house and at some extreme point of the distribution system. In some cases this practice proved to be good, and the disturbances were eliminated, while in other instances there was a contrary effect. Very serious disturbances were caused upon some telephone and telegraph circuits. In one case of telephone disturbance it was found that the principal cause was a third harmonic due to an oversaturated transformer. The Milan city

plant, operating at 60,000 volts, has the neutral grounded through a water-jet discharger. Operation is fairly good, but interruptions of service are more frequent than on plants using the delta connection. The latter is usually favored, the grounded neutral having the following disadvantages: (1) With good circuit-breakers a ground on the line will always result in an interruption. (2) Grounding through a resistance presents the disadvantages of both insulated and grounded systems. The disadvantage of the insulated system is that the full delta tension is put on an insulator when a line is grounded, but when the neutral is grounded through a resistance, an accidental ground through a low resistance can give such a drop on the neutral connection that the tension on the insulation may rise quite near to the full delta tension. (3) A ground connection is never very certain and it is effective only locally. Hence, one ground on a large system is not considered sufficient. (4) If neutrals are grounded without resistance they are likely to disturb telephone and telegraph circuits. (5) In Italy lines are overinsulated. There would be no advantage from grounding in the direction of reducing the cost of the line. (6) The grounded neutral does not obviate the disturbances on long lines due to traveling surges caused by atmospheric influences. (7) The accumulation of static charges which is prevented by a grounded neutral can also be obviated by using water-jet dischargers.

W. W. Lewis referred to statistics of 35 transmission systems using voltages of 70,000 or over, of which about 50 per cent use a grounded neutral. Most of these installations have been put in during the last seven years and it is natural that practice has not yet become settled with respect to either method. He selected six typical systems, three of which use the insulated delta connection and three the grounded star, and discussed their operating experience. The three former are the Great Western Power Company, the Colorado Power Company and the Au Sable Electric Company. Lightning is severe on all of these; the first has little trouble from it, however, although short-circuits and arcing grounds do cause some trouble. The principal trouble on the Colorado line is due to short-circuits from wires swinging together during wind storms, and arcing grounds due to swinging against towers or ground wire. Both of these usually cause shutdowns. It has been found impossible to operate the long Shoshone-Denver line with one conductor dead grounded on account of the increase in corona loss and charging current. On the Au Sable system lightning causes the insulators to spill over on two or three lines at once, causing short-circuits. The Sierra and San Francisco Power Company, the Yadkin River Power Company and the Pennsylvania Water & Power Company use a grounded-star connection. The first experiences short-circuits about once a month. These are taken care of by separating the lines on the low-tension side and cutting out the affected line. Grounds and short-circuits are frequent on the Yadkin lines. Trouble from short-circuits has been reduced by means of a device consisting of a relay in the neutral which, when operated by a ground current, throws a large resistance in series with the field of the generator exciter, thus momentarily reducing the voltage and allowing the short to die out. The Pennsylvania system has frequent short-circuits due to insulators flashing over during lightning storms. Interruptions have been greatly reduced by a device which short-circuits the line at the station through a fuse, thus allowing the arc at the insulator to becomes extinguished. This is supplemented by another device consisting of series line relays which act on the generator field, opening it and closing it momentarily, the whole action taking place so rapidly that synchronous apparatus does not get out of step. With the assistance of these devices operation is satisfactory. Mr. Lewis concluded that neither insulated-delta nor grounded-star systems are free from trouble, and the amount of trouble is governed largely by local conditions. Two arguments frequently used in favor of the insulated-delta system have been shown to be fallacious: (1) that only voltage troubles need be expected, since phase short-circuits are numerous on the Colorado and Au Sable systems. (2) That a delta system can operate continuously in case of a dead ground on one line. This is only true for very short lines, as on long lines the charging current and corona losses become excessive. The telephone system is also invariably disturbed. On the other hand, short-circuit troubles on a grounded-star system are very severe and auxiliary devices are essential to satisfactory operation.

V. M. Montsinger described the experiments which he and Mr. Blume had carried out in investigating the effect of electrostatic capacity and reactance upon third harmonics in star-connected autotransformers. Curves were shown illustrating the results, and an apparatus consisting of three five-kilowatt transformers, excited by a three-kilowatt generator was set up in the back of the hall to demonstrate the method. Some interesting results were obtained with respect to the voltage of the third harmonic, which depended upon the density of the magnetic flux in the core. Tests were also made on a three-phase transformer, and it was shown how a current of triple frequency could be obtained with appropriate connections. Lantern slides were exhibited showing oscillograms taken in the course of this work.

President C. O. Mailloux appeared at this session and was called upon for a few remarks.

H. S. Osborne discussed the subject of inductive interference on telephone and telegraph circuits. The present disturbances from the transmission lines of the Pacific Gas & Electric Company are very serious—more so than for the other power companies in California. This is no argument against the grounded-neutral system, however, because many of the other companies also use this system. The experience of the telephone companies, however, does not lead them to agree with the conclusions of the authors of the paper. Mr. Osborne presented a tabulated comparison of the two systems with reference to telephone interference. Interference would be similar from the two if they were both perfectly balanced. The differences arise when the system is thrown out of balance. The comparison indicated that with either type of connection under abnormal conditions of operation, that is, with one wire grounded or one wire open-circuited, the disturbance in circuits which are exposed to the power line are likely to be so considerable as to put them out of service and destroy the protective apparatus. Currents of high frequency are more objectionable than the fundamental frequency. The experience of telephone and telegraph companies is in favor of the delta connection as against the star connection. In answer to a question he stated that electromagnetic disturbances are of more importance than electrostatic, although the latter occur in some cases. Electrostatic disturbances, however, seldom affect a line more than 200 or 300 feet away from the disturbing circuit. With electromagnetic induction, however, the effects are very widespread.

C. O. Mailloux and E. E. F. Creighton also stated that electromagnetic effects are a greater menace to the telephone line than electrostatic.

John B. Taylor said that the question of star or delta connections could not be settled by argument since both arrangements have advantages and the conditions of use are variable, so that one system may be more advantageous for one company and the other for another. Confusion is introduced into the discussion by assuming that the star connection involves a grounded neutral, whereas it may be used as an isolated system. He disagreed with Mr. Blume as to the necessity of grounding neutrals at both receiving and generating ends of transmission lines. The usual objections to the grounded neutral result from grounding

at more than one point, when so many of the advantages are secured with a single ground. The trouble on one of the lines referred to by Mr. Semenza in Italy is due to grounding at more than one point, causing a considerable current of triple frequency to return through the earth with accompanying induction in neighboring telephone and telegraph lines. The evidence produced by Mr. Lewis shows that the star connection is on the increase.

F. C. Green distinguished troubles affecting the transmission line and those affecting the transformers. Practically no troubles have been experienced with transformers on account of high phase voltage. They are all due to high frequency generated by troubles on the line. Triple-frequency effects do not need to be considered, as they can be entirely eliminated. The grounded star-delta has been shown to give lower voltage stresses than the delta-delta. All connections should be eliminated from the discussion of the star connection except where only one side of the transformer is connected in star and the neutral grounded without any resistance. With the insulated delta, a grounded line always means an arcing ground and the voltage stresses produced are greater and are accompanied by high frequencies. This is the most vital feature of the whole question. With the neutral grounded, the arc is very liable to be steady, since it is maintained by normal voltage. He did not agree that the insulated delta system is better up to 33,000 volts, since the abnormal voltage and frequency caused by a breakdown is just as likely to break down the transformer or other points of the line as on a high-voltage system. He considered the grounded star system safer for both line and transformers at all voltages. He thought the advantage in cost of construction on the grounded star system would be taken advantage of in the near future. He pointed out that the location of a fault is much easier with the grounded star system. The argument for the delta system that one line wire can be grounded without interrupting operation applies only to short lines or low voltages.

P. M. Lincoln stated that the question of the grounded neutral was one that could be settled only by the experience of operating companies and not by designing engineers.

D. W. Roper called attention to a statement of Mr. Fortescue that in four-wire three-phase systems where three-phase power is supplied through star-delta step-down transformers, the neutral point connected to the neutral wire serves as balancer for loads taken off between neutral wire and lines. While this statement is true, it gives a very bad operating condition. The blowing of the fuse on one transformer does not interrupt the service but overloads the other transformers and may result in a burnout. The system was tried in Chicago but abandoned. Arcing grounds have occurred on this system and while not serious, they are quite possible.

F. W. Peek, Jr., did not consider the question of transformer connections very important, since most transmission troubles arise on the line. The insulation of the line is the most important point and there are many inconsistencies in the way this is carried out. Lightning troubles are usually greater on low-voltage lines than on high-voltage lines, because the latter have better insulation. Whether a delta or a star system is used will depend upon the operating experience of the engineer and will be decided from the standpoint of cost. In his experience many of the points brought out in favor of the delta system or the star system had worked in just the reverse way.

J. R. Werth inquired whether any systems are grounded through a reactance, as no reference is made to such a connection in the paper by Mr. Fortescue.

Louis F. Blume stated that a star connection without the neutral grounded did not give much different results than delta connection and consequently the whole discussion rested between the delta-star system and the delta-delta system. The important question is as to operation with a grounded neutral or an insulated system. He agreed with Mr. Taylor that grounding at one point is sufficient with a simple transmission line, but where there are groups of step-down transformers of small capacity over a scattered territory it is not sufficient to ground at one point. Interference due to third-harmonic currents should not be considered an objection to the grounded star system because under proper conditions such currents can be eliminated. He suggested that the trouble referred to by Mr. Osborne was due to the fact that some of the load is between one line and the neutral. A load connected in this manner requires a return circuit through the ground, which is in the nature of an unbalanced load. With the ordinary delta-star transmission system with grounded neutral the loads can be perfectly balanced and this will not occur.

C. L. Fortescue stated that the delta-star connection can be operated just as well without the grounded neutral and has some other decided advantages, one of which is the insulation of transformer windings for the lower voltages required. It is also fully as good as the delta connection from the point of view of electromagnetic stresses. Whether one has current troubles or voltage troubles with either of the connections depends upon the amount of capacity and the amount of energy in the system. As for telephone troubles, the delta-star step-up transformer almost entirely eliminates the third harmonic. He agreed with Mr. Blume that telephone troubles with star-connected systems have been due largely to star-star connections in which the neutral of the star is connected with the neutral of the generator and to the prevalent practice in the West of loading between one wire and the ground. He did not consider that sufficient regard had been taken of the advantages of the star system ungrounded, as compared with the delta system. The higher the voltage the greater the advantage it has. Above 44,000 volts the star connection has the greater advantages whether grounded or ungrounded. He referred to a case where the neutral point was grounded through reactance causing a disturbance on telephone circuits, which was removed with a dead ground.

Mr. Montsinger closed the discussion by reading a communication from Mr. Downing, in which he stated that grounds on delta systems are usually arcing grounds and he considered the delta system detrimental to the system of nearby telephone lines.

President Mailloux occupied the chair at the evening session. The first paper to be presented was by T. S. Eden, entitled "Relative Merits of Star and Delta Connection for Alternators."

Relative Merits of Star and Delta Connection for Alternators.

The main advantages obtained with the star connection are as follows: (1) It is possible to bring out a lead from the neutral point of the winding, which is useful for various purposes. (2) The cost is less than with the delta connection, requiring approximately 58 per cent of the turns. (3) It is not possible for circulating currents of triple frequency to flow in the windings. (4) In general, for the average alternator, the electromotive force wave of the star-connected winding is nearer a true sine than that of the delta-connected generator. (5) The use of the grounded neutral reduces the potential strain on the insulation of the windings, permitting reduced thickness of insulation. The delta connection does not appear to have any advantages except as a convenience in design for certain voltages. When used, proper precautions must be exercised in the design to eliminate excessive circulating currents.

Cassius M. Davis then presented a paper entitled "Delta and Star Connections for Railway Transmission and Distribution."

Delta and Star Connections for Railway Transmission and Distribution.

Transformer connections are discussed under three conditions, according as the railway (1) purchases power; (2) builds and operates the generating and tranmission systems; (3) purchases power and in addition builds and operates a secondary transmission system. The choice between delta and star connection is frequently determined by purely economic considerations. However, it is common practice to use the delta connection on both the high and low-tension sides of transformers, except in the case of six-phase synchronous converters, where the diametrical connection on the low-tension side is the rule. Synchronous-converter substations employing two machines in series for high-voltage direct-

current railways are frequently operated from single banks of transformers, which have double windings on the low-tension sides. Methods of starting have little effect upon transformer connections except in the case of six-phase converters. Transformer connections are seldom important electrically in single-phase and three-phase railway systems. A secondary distribution system may at first be delta-connected and later changed over to star connection to obtain better voltage regulation.

The discussion of these papers was opened by John B. Taylor, who stated that the star connection of generators seemed to be acknowledged to be the best construction. The star-diametral connection has been used for a number of years and there does not seem to be any objection to it. However, there are unbalanced voltages when the transformers are excited and before the load is connected, and the result may be voltages larger than the ratio of transformation would warrant. He cited a case in Waterbury, Conn., 10 years ago, where this increased voltage due to the third harmonic had caused considerable apprehension.

C. J. Fechheimer pointed out the advantages that sometimes are found in delta connection for alternators, but which are of limited application. With delta connections half voltage can be secured very simply, by tapping each side of the delta at the middle point. This is often convenient where 120 volts is desired for lighting and 240 volts for power. Another advantage is in the case of large machines wound for low voltage. Thus a generator for 240 volts and 2,000 kilovolt-amperes would be difficult to construct with star connections. A third advantage is frequently found in the use of existing parts where the connections can be simplified by using delta rather than star connections. He then referred to curious results sometimes obtained with circulating current in the delta of an alternator. This current can be eliminated by using 2/3 pitch winding, as Mr. Eden had stated, and also by inserting reactance at the corners of the delta and tapping this reactance at the middle point. The use of magnetic wedges, which increases the reactance, will also have the same effect. The circulating current can also be reduced by properly designing the shapes of the pole shoes. He pointed out that the circulating current varies with the load and with the power-factor and that a circulating current which is negligible at no load may become of importance at full load. Grounding the neutral of an alternator at one end of the line and the neutral of another at the other end of the line or at a bank of transformers may cause considerable circulating current between the machines, the third harmonic appearing between the neutral and the terminal of the machine, even when it does not appear between terminals. This applies also to two machines in the same station. The effect of circulating current upon efficiency is not so important as upon the heating of the machine, as it may cause the temperature to rise above the safe limit. Owing to the change of circulating current with load, an accurate temperature run can only be made at full load.

E. G. Merrick referred to the reduction of harmonics by a proper proportioning of the pole face. This usually works out with a minimum gap about half the maximum gap. The modern turbo-alternator has a smooth cylindrical rotor and the result must be obtained in some other way. This can be accomplished by a proper proportion between the wound and unwound portions of the periphery, the proper proportion being about one-third unwound to two-thirds wound. He disagreed with Mr. Fechheimer regarding the dependence of the third harmonic upon the load.

R. E. Doherty thought that the difference in the results obtained by Mr. Fechheimer and Mr. Merrick might be due to the different proportion of minimum and maximum air gap in the different machines.

Cassius M. Davis thought it might be due to the fact that at full load the load current obscured the third harmonic of the exciting current owing to the reactance drop in the windings.

John B. Taylor told of a case where the third harmonic had varied with load in a star-connected machine. He thought the matter could be very easily settled by inserting proper measuring instruments in the circuit.

Mr. Eden then closed the discussion and President Mailloux called upon Percy H. Thomas to summarize the results which had been presented at the meeting.

Mr. Thomas referred to papers which had been read before the Institute at previous meetings, indicating that this is an old subject, and while it had been dealt with at length in the past, no definite conclusions were reached. Substantially all of the merits and demerits of each system of connection had been discussed previously, with the exception of third harmonic. This may be reduced if the transformer is star-connected and the neutral points connected together, either directly or through the ground. In the latter case the currents penetrate to considerable distances in the earth. Danger may then be encountered in connection with telephone and telegraph lines, in that these will act as secondary circuits and have current induced within them, which, in turn, will produce disturbances in other systems.

He also referred to similar phenomena in delta-connected alternators or in star-connected alternators, with their neutral points connected together. Whereas in the transformers the third-harmonic current is due directly to the variation in permeability and resultant necessity of forcing the iron through the hysteresis cycle, in the alternator the third-harmonic currents are induced, being caused by the wave form being other than that of a sine, and having in it harmonics of the third degree.

Mr. Thomas also referred to the dangerous potentials which may be induced in secondaries of the step-up transformers on a three-phase system, if they be connected star on primary and secondary, and one of the transformer primaries should become short-circuited, thus raising the potential between neutral and terminal to that potential which should be embraced between terminals. The secondary voltages of these step-up transformers, as well as the transmission-line potentials and distributing potentials on the secondary sides of the step-down transformers would then be increased 73 per cent and may lead to disastrous results.

He further called attention to dangerous conditions which may result with high-potential autotransformers in connection with transmission lines, which may be due to any of the several transient phenomena tending to produce surges, or even to the triple-frequency current, or to line-charging current. Possibly one of the most dangerous sources of surges is that of the arcing ground. Mr. Thomas explained somewhat at length why the arcing ground is generally more serious than that of an ordinary arc.

An Interesting Underground Mining Substation Supplied with Central-Station Current.

The Silver King Coalition Mines Company, with headquarters in Salt Lake City, whose mines are located at Park City, Utah, placed in operation recently what is perhaps the largest and most unique underground hoisting and compressor station in the world. This station, which is located 1,670 feet below the surface, has been made possible only through the fact that its entire equipment is electrically operated.

This underground station has been installed to provide hoisting and compressed-air service for a new shaft on the Silver King mine, from which shaft some of the ore bodies of this company's property can be worked more advantageously.

The station contains three rooms or chambers, occupying a floor space of approximately 3,600 square feet. The walls and roof are of heavily reinforced concrete finished in smooth white cement plaster. The air for the shaft and construction of the station has been supplied by three large compressors from the surface. A motor-driven compressor of the

Sullivan compound type has been installed in the new station which supplies air for the station and shaft and serves as a booster on the main pipe line, this compressor having a capacity of 900 cubic feet of free air per minute.

The motor-driven hoist for operating the cages in this shaft is located in one of the three rooms of the station and is operated by 600-volt direct current from a 250-kilovolt-ampere synchronous motor-generator set also located in the underground substation, which obtains its power from the surface transmission lines through a 2,200-volt cable.

The engineers in designing this plant have arranged it so that the air compressor which is used as a booster to the main air lines utilizes the electric current during the intervals when the hoist is not running, thus eliminating the peak loads which would be occasioned by the superimposition of the demands of the two machines, and which would materially increase the price paid for electric power.

To accomplish this the compressor unloader is connected with the hoist in such a way that, when the current is thrown into the motor of the latter, it automatically unloads the compressor and places all of the power of the motor-generator set, except the friction load of the compressor, available for operating the hoist. When the hoisting current is off the compressor automatically picks up the load, thus providing a high load-factor for the motor-generator set, as well as a nearly constant demand from the supply company's mains.

Current for this installation is purchased from the Utah Power & Light Company.

A party of prominent Salt Lake business men were piloted through the mine by Ex-Senator Thomas Kearns, its general manager, and witnessed the inauguration of service in this interesting new underground station.

Hydroelectric Development in Norway.

The greatest single factor in the industrial development of Norway lies undoubtedly in its cheap and abundant hydroelectric power. The country having practically no coal resources, the Norwegian industries are coming to depend more and more upon the utilization of waterfalls as a primary motive-power source. Water-power rights could formerly be purchased very cheaply, and private individuals foreseeing the possibilities of the future secured title to many of the best sites. Municipalities have also in recent years awakened to the possible advantages of acquiring such rights for future municipal uses. The small mountain streams and lakes not being navigable, their titles are vested in private hands, and can be transferred as any other form of real estate. A few years ago it was an easy matter for foreign interests to acquire such rights, but the deeding of water property to other than Norwegian citizens is becoming restricted. Opinions are even expressed that in a few years it will be difficult for citizens of other countries to lease electric current in connection with industrial enterprises, chiefly because of the efforts being made to have waterfalls developed for the benefit of home industries.

It is claimed that Norway has the cheapest hydroelectric power in the world; the cost of the development is said to average between $40 and $50 per horsepower and in some projects even less. The cost in other countries is said to exceed greatly these figures. The comparatively small cost of the Norwegian power is due chiefly to the proximity of the waterfalls to natural deep-water harbors and almost worthless land at good heights where the clear rock-bottom water is found.

The Stavanger district is one of the richest waterfall sections of Norway, being estimated to contain not less than 500,000 available horsepower, comparatively little of which has been developed. The harnessing of the waters about the Saude Falls is the largest project now on foot. It anticipates the development of some 70,000 horsepower, involving a total expenditure of about 10,000,000 crowns ($2,680,000). The waters about Saude are located at good heights near the head of a narrow arm of the Ryfylke Fjord, where there are excellent harbor facilities and sites for factories. It is planned to make Saude an industrial center rivaling Odda and Aura. Chemical, electrothermic, carbide of calcium, sulphate of ammonia, and cyanamide industries will likely be located here, and possibly other plants for the manufacture of artificial nitrates, aluminum, etc.

The Saude Falls when developed, according to present plans, will have three power stations. The largest is to be provided with four turbines of 10,000 horsepower each and is calculated to cost about $500,000. The actual heights of the water pressure will vary between 650 and 1,000 feet and will be communicated through tunnels to the respective power plants. The largest of these tunnels will have its intake at a height of 795 feet and convey the water 5.25 miles; its dimensions will be 13.12 by 9.84 feet, and its cost is calculated at $350,000. A second tunnel will be 4,920 feet in length and is estimated to cost $60,000; its water will operate six turbines of 5,000 horsepower each. Although the plans for this project are well under way and its construction is assured, actual work will not likely begin before next summer. There are also several smaller projects in the district awaiting development.

Automatic Installation for Galvanizing Tubes.

The following description of an automatic galvanizing installation now in use in Germany is taken from recent numbers of *Electrochemische Zeitschrift*.

The tubes, bars or other objects of similar shape are placed upon endless-chain supports, composed of a series of articulated elements cut in the shape of an incomplete circle, as shown in Fig. 1. These chains are moved by the

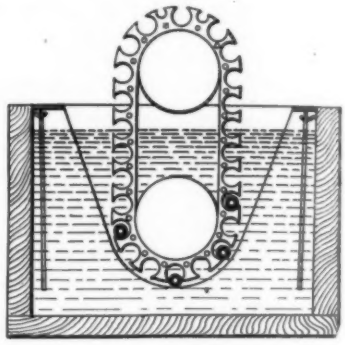


Fig. 1.

rotation of the upper supporting wheel, which is connected to the motive power. The shape of the bottom of the galvanizing vat must be such that the tubes will be carried over and caught on the other side. The chain is run slowly enough so that the workman will have time to pick off the finished tubes and replace them. The apparatus for cleaning and polishing is shown in Fig. 2.

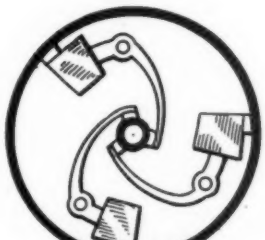


Fig. 2.

It consists of a perforated disk on which are three axes supporting bent levers having at one end a brush, and at the other end a counterweight. When the disk is rotated at high speed the weights will be thrown outwards, thus pressing the brushes against the tubes to be polished. If it is required to clean the inside of a tube of large diameter, the brushes are fixed on the outer surface of the weights.

The Christmas Hotel, Bryan, O., recently installed the only electric dishwasher in that city. The apparatus is giving complete satisfaction and has attracted the interested attention of practically all the housewives in town.

NATIONAL DISTRICT HEATING ASSOCIATION.

Annual Convention, Rochester, N. Y., May 26-29.

The sixth annual convention of the National District Heating Association was held at the Seneca Hotel, Rochester, N. Y., May 26 to 29. The first session was called to order by President S. Morgan Bushnell, Chicago, Ill., at 2 o'clock Tuesday afternoon. In the absence of the mayor, the convention was cordially welcomed to Rochester by Commissioner of Public Safety Charles S. Owens. His address was appropriately responded to by F. B. Orr, of the Illinois Maintenance Company, Chicago.

New members were elected as follows: Class A, 26; class B, 34; class C, 16; associate members, 16.

President's Address.

Mr. Bushnell then delivered his presidential address, in which he briefly sketched the rise and growth of the Association. Commenting on the fact that central-station heating was at first regarded as a rather unwelcome visitor, managers were inclined to avoid the heating problem. Not until the past few years has there been an organized effort to collect and systematize information on steam and hot-water heating, so as to place them on an advanced scientific basis. Mr. Bushnell gave figures to prove that it is highly improbable that steam and hot-water systems of heating will be soon displaced by electrical heating, inasmuch as over eleven times as much heat can be secured from steam for one cent as can be secured from one cent's worth of electricity. Referring to gas competition, he thought this was negligible except in those especially favored districts supplied by natural gas. He then compared the relative advantages of steam or hot-water heating when supplied from a central-station source and when supplied from isolated plants. He showed that the central-station source was the better, tabulating the various advantages. He contended that the claims made to the contrary by advocates of isolated plants had been disproved in practice, and that the installation of isolated plants had been sometimes made under advice colored by self interest on the part of the engineer. The central-station production of electricity for power which at first seemed small and unimportant, has grown until it is on the point of surpassing the production of electricity for lighting; and in view of the rapid changes made in so short a period, who shall say what shall be the limit to central-station production of heating in the more scientifically planned city of the future? Mr. Bushnell referred to the co-operative work being done by the National Electric Light Association and National District Heating Association, not only along engineering lines but on lines of utilizing engineering and business talent to insure practical business success. In 1912 the Association and the American Society of Heating and Ventilating Engineers appointed members of a joint committee to take up certain engineering problems so that the two societies could work along side by side on matters of common interest. The work of this committee, which is called the Educational Committee, during the first year consisted largely in outlining the scope of the work to be attempted, while the committee during the past year has taken up the actual work of determining a code of rules and specifications to be used in connection with district heating. The capital invested in central-station heating stations now runs well up into the millions, and the number of companies engaged has been estimated at from 300 to 400.

Secretary-Treasurer D. L. Gaskill, Greenville, O., presented his annual report showing the Association to be in good financial condition, and reporting 85 active and 15 associate members received during the year, the total net membership at the close of the year being 230 active and 70 associate members. Mr. Gaskill congratulated the members on the fact that they stand today the most active and progressive that the Association has ever had. He especially thanked President Bushnell for his valuable assistance in increasing the membership during the year, and predicted a further increase during the coming year.

Secretary Gaskill made a motion, with the approval of the Executive Committee, for the election to honorary membership of James D. Hoffman, past-president of the American Society of Heating and Ventilating Engineers, and now professor of mechanical engineering, University of Nebraska. This motion was unanimously carried. The Membership Committee, A. C. Rogers, chairman, submitted a report of its labors during the year, and ascribed the bulk of the credit for the additions to the membership during the year to President Bushnell. A nominating committee, composed of W. A. Wolls, A. D. Spencer and J. L. Heck, was appointed to make report at the evening session.

Underground Construction.

The report of the Committee on Underground Construction was presented by its chairman, H. A. Woodworth, Indianapolis, Ind. This made a plea for good construction of underground mains. An analysis of such construction as carried out during the past 35 years shows that more than 15 methods of insulating pipes and various devices to provide for expansion and anchorage have been used. This analysis also shows that the present practice is tending towards standardization. The report dealt further with many types of pipe-line construction and included data on actual construction costs. There was also given a discussion of line losses, depreciation, preservation, etc. Both steam and hot-water systems were dealt with in the report.

Before opening the discussion, John F. Hale, president of the American Society of Heating and Ventilating Engineers, spoke of the value of comprehensive reports such as the Committee had presented. The report was discussed by A. C. Rogers, D. S. Boyden, Henry Meyer, Thomas Donohue, H. A. Ruth, H. A. Austin, R. C. Holley, R. C. Marsh, W. R. Owen and Mr. Woodworth. A number of speakers emphasized the importance of having good underdrainage for the system.

At the evening session the report of the Nominating Committee was received and deferred for action until the following day, in accordance with the requirements of the constitution.

D. R. Mason, of the National Tube Company, Pittsburgh, Pa., delivered an address on "Manufacture of Welded Iron and Steel Pipe," illustrated by moving pictures showing the progress of manufacture. There was a good attendance from the engineering and technical societies of the city as well as the convention proper.

Public Policy of Utilities.

On Wednesday morning the session opened with an extemporaneous address on the "Public Policy of Utilities," by R. M. Searle, vice-president of the Rochester Railway & Light Company. Mr. Searle's address was a frank statement of his opinions on this matter derived chiefly from his experiences in Rochester. The utility company there, as well as other companies of which Mr. Searle is an officer, finds that the attitude of the public toward it is very pleasant. Criticisms occasionally arise but on analyzing them it is found that some four-fifths thereof are constructive, that is, by meeting the difficulties complained of, a complainant is converted into a friend. It is important to respect courteously the rights of all patrons of the company. As an example of how this may be done, Mr. Searle cited a conference he had had with some citizens in a small village located on an interurban trolley line. Their grievances had been converted into an attack on

the rate of fare. On carefully investigating each important complaint, however, and rectifying the difficulty, it was found that they appreciated that the fare was not unfair and they stated that they had been pleased to be accorded courteous attention by an official of the company.

It is important to maintain good relations with the newspapers and in Rochester all of the utility employees, some 6,000, are authorized to speak to any newspaper man for publication if they will tell the truth. Mr. Searle's previous experience with five large utility organizations convinced him that if he ever became an executive he would not handicap a subordinate by making him feel that he could not talk for fear of saying something without authority. No utility should fear any statement by any of its employees, if it is the truth. If it is not the truth, then it is time to find this out because a man who will not tell the truth in public is not likely to tell the truth in his regular routine business relations and a successful utility cannot be built up if any individuals in its organization are willing to tell untruths. As a result of this policy the Rochester utility is held in high esteem.

Mr. Searle narrated a number of incidents showing how his subordinates are authorized to deal directly with prospects and customers of the company. None of these relations are philanthropic. The community is told that the company is clean in its methods, is anxious to give good and efficient service and is ready at all times to treat the public with consideration. The utility should be ready to do little favors for societies and for the citizens in general, because it will develop good will thereby; in order to do this, however, its revenues must not be hampered too much.

Mr. Searle told how the company undertook not long ago to practically clear the streets of its overhead wires. The company had an agreement with the city for doing a certain amount of this each year. It actually had placed underground a great deal more than had been required. However, when the municipal authorities brought up the matter the company explained that to place all of the circuits underground immediately would necessitate an increase in rates to provide the necessary revenue. Since there are no alleys in Rochester, the expedient was hit upon of placing the overhead distribution circuits along the rear lines of the lots and for this purpose pole easements had to be obtained. The matter was explained to the property owners and relatively little difficulty was experienced in taking down the lines along the street and placing them on the rear lot line.

The big man in every utility company must know his people and be perfectly frank and fair with them in order to get their good will. He must leave his office wide open without any reception room and let everybody know that they can come in at any time. The good will developed by this plan has resulted in the sale during recent years of a large part of the Rochester utility's securities. The attitude of the employee to the public is the greatest asset of a public utility. He must understand the policy of the management and deal with the prospects and customers frankly and directly. He should have authority to settle matters on the spot without referring time and again to his superiors. The president of a utility company must be big enough and broad enough to understand his staff and to have enough confidence in them so that when they favorably report to him on any matter to which they have given individual and collective study, to immediately give it serious consideration.

The report of the Meter Committee was presented by A. D. Spencer, Deroit Mich., chairman. This report consisted principally of further descriptions of some new meters and included data on the performance of steam-flow meters and condensation meters. The committee felt it would be premature to draw up any exact specifications defining acceptable meters and stating limits for allowable accuracy. The report discussed the advantages of flat rates for steam heating combined with regulation by thermostats, as compared with metered service, and the conclusion was reached that thermostatic regulation cannot supplant the metering of steam service. The committee's report was discussed by G. D. Bly, John F. Hale and Mr. Spencer.

Election of Officers.

The report of the Nominating Committee was again read, and by unanimous action the nominees were elected as officers for the ensuing year as follows:

President, H. R. Wetherell, Central Illinois Light Company, Peoria, Ill.

First vice-president, D. S. Boyden, Edison Electric Illuminating Company of Boston, Mass.

Second vice-president, B. T. Gifford, American Public Utilities Company, Grand Rapids, Mich.

Third vice-president, George W. Martin, New York Service Company, New York, N. Y.

Secretary and treasurer, D. L. Gaskill, Greenville Electric Light & Power Company, Greenville, O.

Executive Committee: S. Morgan Bushnell, Chicago, Ill.; H. Almert, Chicago, Ill.; C. F. Oehlmann, Denver, Colo.

President-elect Wetherell was then called upon to say a few words; he gratefully expressed his appreciation of the honor conferred upon him.

A communication was presented from Mr. Bascome, of Coshocton, O., requesting information on municipal or other requirements limiting the temperature of water discharged into sewers. This matter was discussed by D. L. Gaskill, A. C. Rogers, D. S. Boyden, F. B. Orr and H. R. Wetherell.

The report of the Station Record Committee was read by A. P. Biggs, Detroit, Mich., chairman. Accompanying the report the committee presented in book form about 250 record forms used by 39 heating companies. The report itself strongly emphasized the value of keeping comprehensive operating records in such systematized form that they constituted complete reports of the station's operation.

This report was discussed by H. W. Whitten, J. P. Hecht, D. S. Boyden and Mr. Biggs.

A. C. Rogers, Toledo, O., then opened a discussion of the relative advantages of operating centrifugal pumps and double-acting pumps. He pointed out that the former type has made wonderful strides in the last five years. However, neither class of pumps can be indiscriminately condemned. The difficulties arising with each type of pump are due frequently to improper design, capacity, or operation of the pump. In Toledo seven centrifugal pumps are used for circulating the water in the hot-water heating system. They have worked very satisfactorily, have eliminated pulsation in the system, and occupied but small floor space.

The discussion was continued by D. S. Boyden, J. P. Hecht, W. A. Wolls, H. A. Woodworth and Mr. Rogers. Mr. Hecht, of the Public Service Company of Northern Illinois, said that experience has shown the centrifugal pump to be much more economical as to maintenance than the reciprocating pump. Although the latter pump may show better initial steam economy than the centrifugal pump, in the long run it is impossible to maintain the reciprocating pump in such condition that its economy will remain better than that of a turbine-driven centrifugal.

The session on Wednesday afternoon opened with a discussion on "Hot-Water Heating Under Forced Circulation," by Thomas Donohue, Lafayette, Ind. He explained that the hot water must be pumped because gravity circulation is impracticable except on the customers' premises. About six

pounds of water per square foot of radiation should be supplied per hour to give the standard drop of 30 degrees Fahrenheit in the water; this amount is often found to reach as high as 50 pounds, however, in poorly piped houses. The pumpage can usually be decreased in a well built system. He believed that the possibilities of hot-water heating have not been fully worked out; it has greater flexibility, higher efficiency throughout the system and greater ease of control than steam, which makes it more popular in residences. The subject was further discussed by W. A. Wolls and A. C. Rogers.

A discussion on "Effect of Superheated Steam on Heating Systems" was opened by D. S. Boyden, Boston Edison Company. He explained the advantages and disadvantages of superheat for this purpose. Among the former are increased economy in boiler plant, smaller allowable pipe sizes, slightly reduced heating surface, lower initial installation cost, and elimination of condensation noise or water hammer in the system. Disadvantages that offset these considerations are increase of distribution losses, danger of severe burns and scalds from the heated ends of radiators and leaks, trouble with pipe fittings, slightly increased cost of maintenance, etc. Considering economy alone, however, the advantages seem to be slightly with superheated steam. This matter was further discussed by Charles R. Bishop, A. D. Spencer, E. L. Wilder, F. B. Orr, W. H. Wells, L. S. Shaw and Mr. Boyden.

Some Effects of Utility Regulation as Affecting District Heating.

Secretary D. L. Gaskill then opened a discussion of this subject in which he stated that the period of regulation is at hand and the only question is whether utility companies shall be regulated wisely and well, or whether they shall be in a continual fight with the body that regulates them. If the public is protected as to rates and service that is all that it can ask. Mr. Gaskill said that as a result of an experience extending over 19 years in the utility business he has become convinced that nearly all of the troubles of a utility are of its own making. If it is managed on the basis outlined by Mr. Searle in the preceding session, so that the business is conducted in a manner that gives the public confidence in the utility, the latter need never fear the effect of regulation by some governing body.

The effect of utility regulation on heating companies will probably be not very much different from its effects on electric lighting and other utility companies. In the heating business there are not as many details as in the electric business, nor is there as much likelihood for people becoming dissatisfied. The chief differences which have arisen between heating companies and their customers have had largely to do with rates. Much of this is due to the fact that the public has not been properly educated as to heating rates.

In practically all states where utility regulation is in vogue, when a complaint is filed as to rates the case comes before the public utility commission. In this connection Mr. Gaskill strongly emphasized the need of each company knowing just what are its costs. It is unlikely a utility company will lose its case if it can show by competent evidence what its costs are. Only those utilities have lost out that have had no record of what they were doing. The laws are construed and frequently specifically provide that a utility shall not be compelled to give service at a rate which will not permit it to meet all its costs and also to pay a reasonable profit upon its investment. Mr. Gaskill cited a recent case of an Ohio company that had kept no record of costs or of investment, and was, therefore, in danger of losing its case until the Ohio Electric Light Association came to its rescue and secured an expert valuation on its property. He also cited another Ohio case which by contrast was won because the company had complete data available, even though politicians had to be fought in working out the case.

Replying to a question by Thomas Donohue, of Lafayette, Ind., Mr. Gaskill said that the situation in Ohio as to utility valuations is a peculiar one. The Ohio Commission, in order No. 176, had recently ordered every utility to file with the Commission before August 1, a complete inventory and valuation of its property. The utility companies knew that this would be a difficult thing to secure in such a limited time. Therefore, the state associations representing the different classes of utilities took the matter in hand. The Ohio Electric Light Association ordered an assessment levied. A committee of five, known as the Appraisal Committee. was appointed with authority to call to its aid the service of the leading utility and valuation experts in the United States. These are preparing forms. The Committee has opened an office in Columbus, O., and will maintain its headquarters there for some two years. Each company has been urged to ask the Public Utilities Commission to grant an extension of time. This has been done by the Commission. The forms prepared by the experts are to be sent out to the companies with explicit directions just how to make their appraisal. These forms are then to be returned to the committee, which will look over the matters, make suggestions regarding their completion and, if necessary, will send an engineer to the utility to assist in completing the appraisal. This procedure was determined upon not with the idea of thwarting the Commission's orders, but on the contrary to enable every utility represented by the state association to file a proper appraisal so that its overhead expenses and intangible valuations may receive proper recognition. Mr. Gaskill expressed the opinion that probably not 10 per cent of the utilities in the country know anything definite about their overhead or intangible values, and have no record thereof. The physical property is easily appraised, and if this is all that appears on the appraisal, the rates based on this valuation will very likely be so low as to put the company in distress.

The matter was further discussed by J. C. Hornung, H. O. Pond, Messrs. Donohue, Rogers and Gaskill.

District Heating For Small Towns.

A paper was then presented entitled "District Heating for Towns and Cities of Ten Thousand Population and Under." This paper was presented by L. T. Mason, of Hornell, N. Y. Mr. Mason opened his paper by the statement that this matter is determined very largely by the local conditions. If the plant is so located and the buildings to be heated are so scattered that the interest and depreciation on the investment required would be more than the business would warrant, it could not be considered a desirable proposition. However, the majority of small electric plants are so located that by adding steam heating, constructed on modern lines, and by selling their exhaust steam by meter, they could be made to pay good dividends on their total investment. Early opinion held that steam heating is an unprofitable business. This has been shown to be due to faulty line-construction methods and to flat-rate methods of charging. There has been a great revolution in methods of district heating in the last 25 years. In undertaking a system of this kind the best materials and the most modern methods must be used in order to get satisfactory results. With improper operating conditions eliminated and the rates for heating based on the assumption that all steam sold is generated expressly for heating, there is no question of making a profit. In many communities there is a demand for central-station heat distribu-

tion. The question therefore arises, will the existing electric light plant meet this demand or will it allow heating companies to be formed?

The discussion was opened by Secretary D. L. Gaskill, who referred to the difficulty experienced in Ohio in obtaining information of this nature from small operating companies, who seem to fear that anything given out may be used in raising the valuation of the property for taxation. On account of the peculiar taxing methods in vogue in Ohio, which Mr. Gaskill explained at some length, it is easy to see why utilities are cautious. H. R. Wetherell and Mr. Mason also discussed the paper briefly.

A discussion on the subject "Which is More Profitable—To Shut Off Steam at Night or To Keep It On Continuously?" was then opened by E. L. Wilder, Rochester, N. Y. He showed that there are a number of considerations involved in this question. He discussed what happens in a room which has been heated to a considerable temperature and then has its supply of heat stopped. In some buildings it is not allowable to let the temperature drop below a certain point, but in many factory buildings it has been found that a saving of 10 to 30 per cent may be effected by intermittent heating.

Others who discussed the subject were D. S. Boyden, Boston, Mass.; H. R. Wetherell, Peoria, Ill.; C. H. Spiehler, Dayton, O.; E. B. Tyler, Pittsburgh, Pa.; G. D. Bly, Toronto, Canada; R. C. March, Chicago, Ill.; F. M. Noecker, Renovo, Pa., and H. W. Whitten, Boston, Mass. Some difference of opinion was expressed by the speakers as to which was the better practice, this evidently being due to different conditions and requirements in buildings used for different purposes.

A paper presented by J. Byers Holbrook, New York City, entitled "Heat Loss from Buildings of Latest Construction," was then read by Secretary Gaskill in the absence of the author. This paper gave formulas for determining heat losses in which was involved a prior determination of the radiating surface.

District Heating Versus Isolated Heating.

The next subject taken up was a general discussion of the economic advantages to consumres of central-station heating service over individual heating plants. This discussion was opened by A. C. Rogers, Toledo, O., who said that in Toledo about 99 per cent of the hot-water heating system is in the residence districts. In taking up the advisability of central-station heating with prospects it is necessary that they be asked to consider the actual total cost of operating their own heating plant; included in this must be the investment in boilers, rental value of the space taken up for boilers and fuel, and the entire cost of operation and of depreciation of the private plant. The heating rates used in Toledo make the cost of heating from the central station 10 to 20 per cent less than the cost of heating by the old individual plants. Where difficulty is experienced in convincing prospects of the value of the service it is due to the fact that they are prone to consider only the fuel bills of their plant without considering all other elements of cost and convenience. Among the latter features are the elimination of dirt and dust and the damage these produce on the interior furnishings of the building. The fire risk is also reduced when the private plant is eliminated. The customers who have been served by the heating system have found that their fear that the service would be a luxury has been entirely groundless and instead of being a luxury it has turned out to be a necessity.

H. R. Wetherell, Peoria, Ill., said that his experience had been that it was by no means always possible for a district-heating company to heat a man's building cheaper than the owner can do so himself. He usually tells his prospects that if they sign a contract on the flat-rate basis their bill will possibly be twice their former fuel bill. However, by using the meter system and operating a plant intelligently it may be possible to secure the service at less cost than from the individual plant. It is usually found that when a customer realizes the advantages of 24-hour service he makes more liberal use thereof and will heat his building more months in the year than he would operate his own plant.

G. D. Bly, Toronto, Canada, mentioned a case of a customer who had regarded his bills as being excessive, therefore he operated his own plant for one year. Now he is again taking central-station heating. While he was operating his plant heat was shut off from four in the afternoon until eight in the morning, whereas, with the central-station heating was supplied from five in the morning until ten at night. If the customer will ask only the same service that he would supply himself he can almost invariably be served more cheaply from a central station.

W. A. Wolls, Columbus, O., told of a superintendent of a state institution who had enthusiastically recommended the renewal of the central-station steam-heating service, although the board of control had considered installing an independent plant. It had been found that while central-station service was provided it had practically eliminated pneumonia among the inmates of the institution, who were children under two years of age.

L. T. Mason, Hornell, N. Y., said that the installation of a meter practically compels the customer to put his equipment into first-class condition. Thomas Donohue, Lafayette, Ind., said that every central-station heating company should freely give advice and information to its customers on how to get the best results from the service.

Charles R. Bishop, American District Heating Company, North Tonawanda, N. Y., cited a case where a twenty-story office building with about 400 offices, will probably be piped so as to have a meter for each suite of offices. It is believed that this will increase the heating revenue very materially and at the same time avoid arguments between tenants and owners of the building. H. R. Wetherell said that his company insists on providing only one type of service to each building, and cited a case where the use of two different systems had resulted in inequitable bills to two customers in the same building.

On Thursday morning the session was opened with a discussion on the subject of "Customers' Steam Heating Systems." H. R. Wetherell, Peoria, Ill., presented a written discussion on this matter in which he described various types of equipment in use on the premises of central-station heating customers. He pointed out some of the advantages and difficulties connected with each of the systems described. This matter was discussed further by H. A. Woodworth, Indianapolis, Ind., R. P. Bolton, New York City, R. C. March, Chicago, Ill., and A. C. Rogers, Toledo, O.

George W. Martin, vice-president of the New York Service Company, then presented a paper entitled "Commercial Steam Heating in New York City." This paper dealt almost exclusively with the practice of the New York Service Company, which operates a number of individual plants for supplying steam for heating and for industrial uses other than for power. This company has been operating for about two years with excellent success. He described the nature of the agreements made with various owners of buildings, the forms of contracts, log sheets and records, and gave data on the heating service for five different buildings.

The discussion of this paper was opened by R. P. Bolton, New York City, who emphasized that one of the most important features on which the success of such a company depends is the careful supervision of the firing

and purchasing of appropriate fuel. He discussed at length the relative economy obtained in various buildings, dwelling particularly on the manner in which the coal is fired and the number of firemen employed for buildings of almost identically the same character. Considerable difference in labor cost was noted. Mr. Bolton also referred to the cost of maintaining steam in summer, which in most private plants he has found to be very excessive.

D. S. Boyden, Boston, Mass., Fred B. Orr, Chicago, Ill., Charles R. Bishop, North Tonawanda, N. Y., and Mr. Martin continued the discussion.

Heating Rates.

E. L. Wilder, chairman of the Rate Committee, then presented the report of this committee. Included in this were diagrams showing steam rates in use in seven states. Also one showing the average steam meter rates of these different states. It is now being recognized by heating companies that the radiating surface installed in a customer's premises bears little relation to the amount of steam used. In the case of steam-heating companies the charge may be divided into two parts —one being a charge proportional to the steam demand and the other proportional to the amount of steam actually consumed. Since there is no inexpensive instrument for determining the maximum demand, this is usually based on the square feet of radiation installed, but this value must be modified by a factor depending upon the nature of the building, its exposed window and wall area, thickness and material of outer walls, cubical contents, forced ventilation and general exposure. The quantity of steam actually used is now almost invariably determined by a meter. This permits a two-rate charge, which has been found very satisfactory in actually making the charge correspond to the cost of giving the service. For hot-water systems the flat-rate system is the method ordinarily employed, which is really a demand charge based on the calculated heating requirements. In the case of customers whose demands are essentially off-peak, the charge may very appropriately be decreased.

The discussion was opened by A. C. Rogers, Toledo, O., who stated that the Ohio Public Utilities Commission has given authority for charging customers on the demand or readiness-to-serve basis even though they do not take heat for a full season. A. D. Spencer, Detroit, Mich., W. G. Carleton, New York City, Henry Meyer, Terre Haute, Ind., R. C. Holley and Charles R. Bishop, North Tonawanda, N. Y., Thomas Donohue, Lafayette, Ind., R. P. Bolton, New York City, F. M. Noecker, Renovo, Pa., and Mr. Wilder continued the discussion.

Station Operation.

The final session of the convention assembled on Thursday afternoon. The report of the Station Operating Committee, of which Byron T. Gifford, Grand Rapids, Mich., is chairman, was presented; in the absence of the chairman the report was read by Secretary Gaskill. This report was prepared by a number of men prominent in the district-heating business and touched on two main topics, namely, boilers and general operating conditions. Under the former there was discussed the rating and capacity of boilers, the relation of capacity to efficiency, the relation of CO_2 to efficiency, water purification. Under general operating conditions there was a discussion of conditions relative to a steam-heating plant and of those relating to a hot-water heating plant. Contributing to the committee's report were E. C. Fisher, of the Wickes Boiler Company, D. S. Jacobus, of the Babcock & Wilcox Boiler Company, Joseph Harrington, and Frank Vatter, of the Power Plant Specialty Company.

The report was discussed by George W. Martin, New York City, who emphasized the need of close attention to boiler-room economy. R. P. Bolton, New York City, discussed the operation and design of boilers, pointing out particularly the trend toward the vertical boiler. He predicted that in the near future we may see boilers with a rating of 5,000 horsepower. J. P. Hecht, Chicago, Ill., stated that he also had found it common for engineers to pay much more attention to the engines than to the operation of the boilers.

C. N. Green, of the Public Service Commission of the First District, New York, then made a brief address calling attention to the book published by Delos Wilcox, formerly of that commission, which deals with franchises for various utilities. He suggested that this be referred to in collecting forms of franchises.

D. S. Boyden, Boston, Mass., chairman of the Educational Committee, then presented the report of this committee, which has been gathering much data, information and references of value to the district-heating business. The Association's committee has cooperated with a similar committee of the American Society of Heating and Ventilating Engineers. The co-operation of other organizations in the work was urged. In appendices to the report were given: (A) recommended pipe sizes and radiation for heating systems, suggestions regarding steam meters, proposed new standard for flanges and flanged fittings, effect of weather stripping on air leakage and radiation of buildings; (B) rules for prevention of accidents, regulations for employees, first aid to injured, resuscitation from electric shock, etc.; (C) tests of low-pressure steam vegetable cooker, analysis of effect of weather conditions on heat output of a district-heating plant, further pipe data, etc.

On motion it was decided to carry out the recommendations of the committee asking the American Society of Mechanical Engineers and other organizations to appoint representatives to a joint committee. The matter was discussed further by Mr. Boyden, H. W. Whitten, Boston, Mass., and Henry B. Smith, Jr., Bay City, Mich. The convention then adjourned.

Entertainment.

Although the convention program was well filled with technical and business matters, time was reserved for some enjoyable entertainment features. The ladies were entertained during the sessions by automobile rides, card parties, lake trips and shopping tours. On Wednesday evening a theater party was given for all in attendance. Thursday afternoon the men visited the works of the Taylor Instrument Company in Rochester.

On Friday the entire convention was the guest of the American District Steam Company, of North Tonawanda, N. Y. A special train composed of five Pullmans and a club car left at 9:30 a. m. The first stop was made at Lockport, N. Y., the home of the original central heating plant. The entire party was conveyed through the principal residential and business districts of the city, including a visit to the heating plant on Elm Street, by large motor sight-seeing trucks. After returning to the train, the next event was the luncheon tendered by the company at its works in North Tonawanda. Then followed an inspection of the large plant devoted exclusively to the manufacture of materials for use in the construction of central heating plants and of "Adsco" specialties. Subsequently the trip was continued to Niagara Falls, where all enjoyed a ride in special cars around the scenic gorge route, thence to the Clifton House on the Canadian side for dinner which was served about 7:30 p. m. At the close of dinner Secretary Gaskill expressed the appreciation of those present for the hospitality displayed by the company and remarked concerning the very able manner which had attended the conducting of every part of the schedule. Mr. Wells, president of the company, responded very graciously. The return trip to Rochester was made via Buffalo.

New Electrical and Mechanical Appliances

New Single-Phase Watt-Hour Meter.

A new single-phase watt-hour meter, representing what is believed to be a distinct advancement in the design of meters operating on the induction principle, has recently been placed on the market by the General Electric Company, Schenectady, N. Y. The salient features embodied are high initial and maintained accuracy, micrometer adjustments, solid structure assuring permanent alinement of working parts, very legible register, easy access for inspection and repairs, simple construction, compact design and neat appearance. The meters are offered self-contained in capacities of 5 to 300 amperes, 110 or 220 volts, two-

New Single-Phase Meter.

wire, and 5 to 150 amperes, 220 volts, three-wire, 25 to 133 cycles.

The mechanical design of the meter is a marked departure from that heretofore used. The base, or central iron casting, supports the complete motor element on the inside, and the damping magnets, bearings and registering mechanism on the outer or front side. An extension at the bottom forms the terminal box. The fact that all working parts are rigidly attached to this single integral casting assures accurate alinement during operation, while being transported, or also when it becomes necessary to take apart and reassemble the meter.

There is the usual key-holed support in the top at the back of the base casting. The two holes for the lower supporting screws are inside the terminal box and, when the meter is connected in circuit and sealed, these screws are sealed also. The leads enter the bottom of the box, the brass terminals being permanently molded into place in a noncombustible insulating compound.

The iron back plate is secured by screws entering from the front side of the base casting, which are accessible only when the front cover is removed. The cover is stamped from sheet zinc and has the two usual glass-covered openings for observing the register and the rotation of the disk. The cover and plate joints are packed with felt gaskets to render them dustproof. Two seal pins and wing nuts in front hold the cover in place and provide for sealing in the usual manner. Meters with all-glass covers can be furnished, if desired.

The rotating element consists of an aluminum disk mounted on a vertical shaft with a worm cut in the upper end, which transmits motion to the wormwheel at the back of the register. The lower shaft bearing is a sapphire mounted in a brass screw, which is readily accessible and can be removed and replaced in its original position without adjustment. A brass cap is screwed on over the end of the jewel screw and acts as a guide, preventing the pivot from jumping out of the cup in the event of some disturbance in the circuit. The top bearing consists of a flexible steel wire mounted in a removable brass plug supported by the main casting, and extends down into a washer mounted in the top of the shaft.

The magnetic circuit is in two sections rigidly fastened together by two punched iron reinforcing plates. There are two current poles and one potential pole. Three screws hold the entire element in position inside the base. The permanent magnet, by means of which the speed of the disk is regulated, has two individual magnets astatically arranged and mounted in a brass shoe. It is supported by a shelf on the main casting and provided with micrometer adjustment. Turning the screw clockwise draws the magnet out, decreasing the speed of the disk, and vice versa.

A slotted and knurled thumbscrew gives micrometer adjustment for light load by moving a metal punching laterally under the potential pole in the path of the potential flux. Two brass studs project from the molded compound in the terminal box, joined by a small brass connection strap, by means of which the potential circuit may be opened and any number of meters tested in series.

In the 100 to 300-ampere capacity meters the current-coil laminations are of slightly different dimensions to accommodate the larger winding, which

Meter with Cover Removed.

is of strip copper terminating in cast lugs molded into a terminal block of insulating compound. This block is fastened to the base by three screws entering from the rear. A set of two or more lugs or terminals is furnished with each of these meters.

Two holes punched diametrically opposite in the disk prevent creeping or turning on potential alone. The meters are practically unaffected by variations in voltage 10 per cent above or below standard ratings. Ordinary variations in temperature, small changes in frequency met with in lighting circuits, or variations of wave-form of generators for such service also do not affect their accuracy appreciably.

A lagging device, consisting of a rectangular copper punching in the

form of a short-circuited loop and attached to the light-load plate, compensates the meter for inductive loads. It is tested and adjusted at 0.5 power-factor. The iron case surrounding the electrical element protects it from the effects of ordinary external stray fields. The astatic arrangement of the permanent magnet tends to eliminate any influence on the damping system. The central iron casting shields the magnets from the effects of short-circuits that create a heavy field within the meter itself. The accuracy of the meter is thus practically unaffected by stray fields.

New Pass & Seymour Fittings.

The firm of Pass & Seymour, Incorporated, Solvay, N. Y., has added two more new fittings to its well known line. The one shown in Fig. 1 is a porcelain

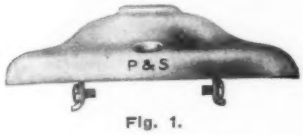


Fig. 1.

rosette designed for use on outlet boxes only. It is made in two sizes, for the 4-inch and the 3.25-inch boxes. The hole in the cap of the rosette is arranged to receive so-called fixture loops, thus permitting its use with chain fixtures and making a very inexpensive and yet presentable fixture. The line terminal screws are conveniently placed so as to be readily accessible; these screws are long and upset to prevent dropping out.

A new sign receptacle is shown in Fig. 2, which gives a good idea of the parts

Fig. 2.

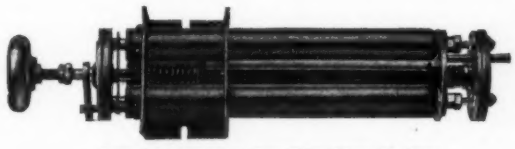
of the device. This receptacle was designed to meet the latest desire of certain underwriting interests with regard to a receptacle that it is not possible to turn after it is once placed in position. The receptacle has five notches. When installing it, it is necessary to cut only one projection in the metal face. This projection when bent down into any of the notches gives practically any desired position of the receptacle and prevents its subsequent turning.

Allen-Bradley Speed Regulators for Slip-Ring Induction Motors.

The Allen-Bradley Company, Milwaukee, Wis., has recently developed a speed regulator for slip-ring motors which is claimed to have decided advantages over the ordinary wire-wound or grid-type resistance regulators on the market. The latter are generally rated to give a maximum speed reduction of the motor at full load of 50 per cent; that is, on the first contact on the face plate of the regulator, the speed of the motor is cut down one-half. Now, assuming that the operating lever was left on the first contact and the load on the motor reduced to one-half of what it formerly was, it would then only be possible to reduce the speed of the motor 25 per cent, since the speed variation of a slip-ring motor is entirely dependent upon the load of the same and the limited number of contacts would not permit of a greater speed reduction.

It is believed that the apparent shortcomings of the old form of regulator have been entirely overcome by the Allen-Bradley carbon compression-type speed-regulating devices. This is made possible by the fact that a resistance range of 100 to 1 can be obtained by means of the carbon-compression resistor and therefore the regulator can always be adjusted by turning the handwheel to give the desired speed reductions. Of course, this could also be accomplished with the wire-wound or grid-type resistance regulator, if the number of contacts and corresponding speed steps were greatly increased; however the complexity, bulkiness and cost of such a device makes the same prohibitive for general use. With the new type of regulator the speed variation obtainable is entirely independent of the load.

The illustration herewith clearly shows the simplicity and compactness



Speed Regulator for Slip-Ring Motors.

of the Allen-Bradley regulator. The resistance and corresponding speed variation is obtained by turning the handwheel which gradually compresses the carbon disks contained in the steel tubes, which are thoroughly insulated from the same. One of such resistance units is supplied for each phase. The applied pressure is absolutely equalized by means of proper mechanism so that the phases are never unbalanced. Another point of advantage over the old wire-wound or grid-type resistance is the fact that the resistor employed is practically indestructible. It cannot burn out, nor is it affected by the action of moisture or corrosive fumes.

Instead of obtaining only as many speed variations as there are contacts on the face plate of the regulator, it is possible to obtain an infinite number of steps with the carbon-pile resistance, which is a feature of great importance. Any slight turn of the handwheel effects a change in the speed of the motor, so that the same may be adjusted exactly to operating conditions and held at that point. This method of control also does away with button contacts or renewable segments and consequently all arcing in moving the operating lever from one contact to another is entirely eliminated.

This speed regulator is very compact in design and light in weight, although it has a very large overload capacity. For 50-per cent speed reduction, it is made in sizes up to 10 horsepower for fan and similar duty, while up to the present time 5 horsepower is as high as these regulators are rated for machine duty. The Allen-Bradley Company, which manufactures this device, can build the same of larger capacities, however, if a smaller percentage of speed reduction is desired.

Electrical Portrait of Mr. Edison.

One of the electrical decorative features at last week's covention of the National Electric Light Association in Philadelphia, was an electrical portrait of Thomas A. Edison made from his recent photograph.

This feature brought out Mr. Edison's face in a most realistic way, the various colors being faithfully portrayed, such as flesh, hair, collar, tie and coat. The whole had an appearance of being a well illuminated oil painting, although carried out in somewhat of a poster effect.

At the close of the convention, T. C. Martin presented the portrait to Mr. Edison with the compliments of the electrical men of the country. The picture was made by the Greenwood Advertising Company, under the Tucker-Leach patents pending, and is an ingenious piece of work, the high lights and shadows being reproduced by reflections and re-reflections. The entire display is made of metal, and surrounded with a frame.

Electrical Curing of Lumber.

An electrical device for the curing of logs and lumber in such a way as to prevent sap stains is in actual and successful operation at the mills of W. W. Gary, at Inverness, Miss., and of Monroe McChord, of the same place. The device is the invention of J. P. Sullivan, of Memphis, Tenn., who is exhibiting letters from the two Inverness men to the effect that his device is doing all he claims for it and proving more than practical.

The New Plant of Mathias Klein & Sons.

Mathias Klein & Sons, Chicago, Ill., manufacturers of telegraph, telephone and other linemen's tools, have recently removed to a much enlarged plant at Belmont and Kedzie Avenues.

The growth and history of this company, whose products are regarded as standard by linemen, is of much interest. Mathias Klein, now 88 years of age, but still able to take an active part in the management of the plant, putting in the usual working day of from 7:00 a. m. to 5:30 p. m., was first employed in Philadelphia, Pa., as a blacksmith at $6.00 per week. In 1855 he came to Chicago, Ill., and in 1857 opened a blacksmith's shop. At about this time, much telegraph work was being carried on throughout the country. Linemen of what was then known as the Illinois & Mississippi Telegraph Company, finding that ordinary pliers and other tools were not suited to their work, began to come to the shop of Mathias Klein for the purpose of having tools made that more nearly fulfilled their needs.

Mr. Klein not only tried to make the tools as requested, but he sought to give the men stronger tools and tools that more than merely fulfilled their needs than those that they specified. As a result it was not very long before the Illinois & Mississippi Telegraph Company, as well as numerous similar companies, became interested in his shop and began to order their standard lineman's tools from him.

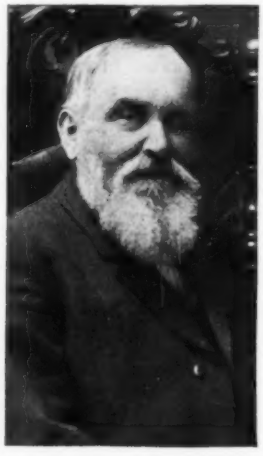
The business grew steadily and the shop had to be moved a number of times to get increased space. When the great fire of 1871 occurred, the shop was located on Dearborn Street where the Great Northern Hotel is now situated, the conflagration wiped it out of existence, but it was immediately rebuilt and continued at that location until 1881. In that year a two-story and basement building was erected on Van Buren Street, two blocks west of the river; its ground area was 25 by 50 feet and Mr. Klein thought that the climax of the business had been reached. However, additions had to be made several times and the shop was rebuilt in 1891 and further added to later so as to have over eight times the floor area that it had in 1881. Even this proved inadequate and in 1906 a large additional factory was built on Clybourn Avenue near North Avenue.

This had been considerably enlarged when in 1913 the firm decided to build its present three-story plant at Belmont and Kedzie Avenues. Throughout this period of development, Mr. Klein sought to make better tools than specified and to make constant improvements in them, thus bringing his tools into the favor of all linemen. Mr. Klein has succeeded in obtaining the personal respect and good will of his employees, some of whom have been in his employ as long as 42 years.

The company's new plant is situated in a 65-acre plat of land, so as to provide for future expansion. The factory building may be considered as being built in three sections. One of these sections has a ground area of about 15,300 square feet and is three stories in height. At right angles to this section is a one-story section having a ground area of about 13,350 square feet. To one side of this section is located a 55x100-foot building which is utilized as a power house, gas-producer plant, boiler house, etc. The total floor space of the factory is hence about 64,750 square feet.

The company's new plant is modern in all ways, every effort being made to make the plant a pleasant and a

John M. Klein.



Mathias Klein, Founder of the Firm.

Joseph A. Klein.

Factory Occupied Till Last Year.

New Factory Completed Last Fall.

sanitary place in which to work. Numerous windows and a complete ventilating equipment have done much to remove the gloom, dust and foul air of the average forge shop, grinding rooms, finishing rooms, etc.

In the power house are situated a 100-kilowatt, Corliss-engine-driven Western Electric three-wire generator for supplying light and power. Here are also located the various water heaters, steam pumps, and the equipment for heating the building. Apparatus for the pneumatic sprinkling system as manufactured by the Rockwood Sprinkler Company, of Chicago, is used for fire protection throughout.

On the same floor is situated a Flinn and Dreffein gas producer which is used to furnish gas to the various furnaces on the different floors for forging and tempering. This gas producer furnishes from 1,300 to 1,400 cubic feet of gas per hour, using for this purpose about one ton of pea coal per day and about fourteen gallons of water per minute.

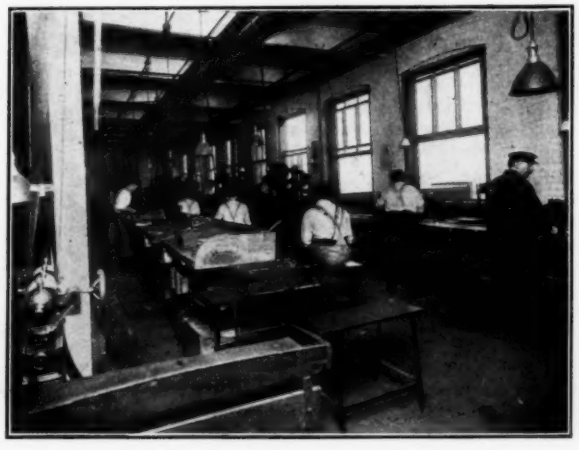
Plier Forge Shop.

Plier Finishing, Tempering and Inspection Department.

Climber Finishing Department.

Milling and Drilling Department.

Plier Assembling Department.



Plier-Connector Assembly Department.

On this floor are also located stock and shipping rooms as well as a forge shop. The raw material for pliers is taken to the forge shop where it is heated in the small producer-gas furnaces and drop forged to shape by means of various types of drop hammers driven by belts from two overhead lines of motor-driven line shafting extending the length of the room on each side.

After being forged the parts of the pliers are taken to the second floor where they are milled to correct shape on milling machines equipped with special tools. From the milling department pliers are taken to the assembly room on the third floor where they are assembled. After being inspected, pliers are taken to the tempering department where they are heated in gas furnaces, the temperature of which is always kept at a known constant value by means of Hoskins electric pyrometers connected to each furnace. Having been heated to the desired temperature, pliers are withdrawn from the furnaces and oil-tempered by means of tempering process found to be the best for the purpose by the manufacturers.

When tempered, pliers are sent to the finishing and grinding departments where they assume their final form. In order to protect the man in the grinding department from the harmful dust prevalent in such shops, each grind stone is provided with a special suction hood which carries the dust and particles resulting from the grinding operation to the outer air.

After being finished pliers are subjected to rigid inspection, and placed in packages for shipping.

In addition to manufacturing the well known "Goehst" wire-cutting and other pliers, this company also manufactures poleman's climbers, wire-reels, pole construction tools, etc.

At the present time about 133 men are employed in the new plant, but in spite of enlarging its facilities and even doubling its plier force since last October, the company cannot keep pace with its orders. Last year about 85,000 pairs of pliers were sold, an increase of about 20,000 over the previous year's sales. Orders for climbers run as high as 3,000 to 4,000 dozen pairs, yet Mr. Klein recalls the time when an order for a dozen climbers was considered a large order.

In addition to the various metal-working processes carried on in the plant, a complete woodworking shop is also provided for making the wood parts of pole tools, wire reels, carts, etc. A complete stock of raw material is constantly kept on hand, so that the factory need at no time be hampered by the lack of raw material. In order to improve the general efficiency of the plant each machine is located beneath an incandescent drop lamp with metallic shades, and an eight-station Western Electric intercommunicating telephone system is employed to permit the entire plant being within call of the office.

Mathias Klein maintains that the growth of his business and his wide reputation as a tool maker, are the result of his efforts to produce tools of greater strength and greater convenience than those which meet the minimum specifications for such tools. Mathias Klein is still a true lover of his trade and in place of occupying a desk in his office at 652 Van Buren Street, Chicago, Ill., he prefers to remain at the factory where he can constantly keep in touch with its various operations and have the company of his friends of long standing.

Westinghouse Squirrel-Cage Elevator Motor.

A New Westinghouse Elevator Motor.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just announced that it is placing on the market an alternating-current squirrel-cage elevator motor of new design. The special features of this motor are great mechanical strength, quiet operation, extreme reliability, and excellent performance characteristics.

Rotor of Elevator Motor.

It requires only a simple switch without resistance and is started by being thrown directly on the line. It starts with high torque, so that the car is quickly but smoothly accelerated, but only a moderate starting current is drawn from the line.

The frame is built up of steel laminations, securely mounted between rolled-steel end shields and supported by a rolled-steel foot. This construction provides very great strength with great compactness, so that the motor is readily mounted on the elevator machine.

The shaft and bearings are very large, the bearings are protected from dust, and the stator coils are moisture-proof and can withstand a high degree of temperature.

The rotor is practically indestructible. The end rings are cast solid on the bars, and the insulation is inorganic and will withstand a high degree of heat, moisture and mechanical stress. No solder, screws or bolts are used. There is, therefore, nothing to burn out, deteriorate under heat, or work loose.

Stator for Elevator Motor.

The rotor is comparatively long and of small diameter, which gives a small flywheel effect. This, together with perfect balance and the rigid construction, makes this rotor especially adapted for the frequent starting, stopping and reversing required of motors in elevator service.

These motors are made in sizes of from 3 to 20 horsepower for two and three-phase, 25 and 60-cycle circuits of 220, 440 and 550 volts.

The aluminum output was 72,330,000 pounds last year in the United States. In 1883 only 83 pounds were produced.

Latest Approved Fittings

CABINETS.—NePage, McKinney & Company, Armour Building, Seattle, Wash.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, have labels attached to each cabinet.

Approved April 29, 1914.

BUZZER.—General Electric Company, Schenectady, N. Y.

"G. E." buzzer, alternating current, 2 amperes, 125 volts. Sub-base for combination switch and buzzer catalog No. GE511. For use in series with incandescent lamps to indicate when lamps are left with the current on.

Approved April 30, 1914.

GROUND CLAMPS.—Ideal Clamp Manufacturing Company, 77 Jamaica Avenue, Brooklyn, N. Y.

"Ideal" ground clamp. A two-piece clamp of brass having the ends secured by a single bolt and provided with lug for soldered connection to the ground wire. Made for all sizes of pipe and conduit up to three inches in diameter.

Approved April 20, 1914.

LAMP GUARD.—Harvey Hubbell, Inc., Bridgeport, Conn.

Tinned steel-wire lamp guards.

Non-locking.

For standard sockets, catalog Nos. 5573, 5578, 5591-92, 5623-24 including 5766.

For porcelain sockets, catalog Nos. 5731, 5765, 5820.

Locking guards.

For composition sockets, catalog Nos. 5810, 5818.

For standard sockets, catalog Nos. 5762, 5764.

Approved April 30, 1914.

RECEPTACLES, For Attachment Plugs.—The Cutter Company, Philadelphia, Pa.

"Cutter" flush receptacle and face plate, for use with approved Edison screw-shell attachment plugs.

Approved April 30, 1914.

RECEPTACLES, Standard.—E. H. Freeman Electric Company, Trenton, N. J.

Brass-shell wall sockets.

Key, catalog Nos. 20, 40, 45.

Keyless, catalog Nos. 21, 41, 46.

Pull, catalog Nos. 23, 32, 37, 42, 47, 168, 174, 175, 177-79 inclusive.

Approved May 5, 1914.

RECEPTACLES, Standard. —Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." brass shell, closed or slotted bases.

Keyless, 660-watt, 250-volt.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

For use on metal ceilings, catalog Nos. 1, 44.

Approved April 15, 1914.

ROSETTES, Link Fuse.—Trumbull Electric Manufacturing Company, Plainville, Conn.

"Circle," 2 amperes, 125 volts. Cleat; catalog No. 765.

Approved April 18, 1914.

Economy Extender—Harvey Hubbell, Incorporated.

ROSETTES, Fuseless.—E. H. Freeman Electric Company, Trenton, N. J.

One-piece rosettes, 3-ampere, 250-volt.

Cleat type, catalog No. 318.

Combination cleat and concealed type, catalog No. 319.

Two-piece rosettes, 3-ampere, 250-volt.

Concealed type, catalog No. 335.

Approved April 18, 1914.

Economy Extender Attached to Fixture—Harvey Hubbell, Incorporated.

ROSETTES, Inclosed Fuse.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

Ceiling pull switch rosettes, catalog Nos. 5902, 5903; with "Economy" extender, catalog Nos. 5922, 5923. (See cuts.)

Approved April 18, 1914.

SOCKETS, Weatherproof.—E. H. Freeman Electric Company, Trenton, N. J.

"Freeman," 660 watts, 600 volts.

Two-piece porcelain socket enclosed in a two-piece aluminum shell, catalog No. 186.

"Freeman," 660 watts, 250 volts.

One-piece porcelain socket, catalog 120.

Approved April 30, 1914.

SOCKETS, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." brass-shell sockets.

Pull, catalog No. 482. Also with shadeholder attached, with composition or insulated metal key, with or without extension keys and pull sockets with extension chain guide or insulating link in chain.

Approved May 1, 1914.

SOCKETS, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." brass-shell electrolier sockets.

Pull, 250 watts, 250 volts; catalog Nos. 438, 478.

Keyless, 660 watts, 250 volts; catalog Nos. 470, 479, 484.

Approved April 30, 1914, for fixture use only.

SOCKETS, Weatherproof. — General Electric Company, Schenectady, N. Y.

Porcelain shell, catalog No. 9496.

Approved April 8, 1914.

SWITCHES, Push-Button Flush.—Keil & Sons, Francis, 401-425 East 163rd Street, New York, N. Y.

Push button flush switches shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined and tested at factories and passed by Underwriters' Laboratories, have labels attached to each device.

Approved April 20, 1914.

SWITCHES, Push Button Flush.—Keil & Son, Francis, 401-425 East 163rd Street, New York, N. Y.

Single-pole, 5-ampere, 250-volt, 10-ampere, 125-volt; catalog No. 32501.

Double-pole, 10-ampere, 250-volt; catalog No. 32502.

Three-way, 10-ampere, 250-volt; catalog No. 32503.

Approved April 21, 1914.

WIRES, Slowburning. — Northern Electric Company, Limited, Montreal, Canada.

Tag on coil to read: "National Electrical Code Standard."

Marker: Yellow thread woven in braid, or, one blue, green or black thread in a red braid.

Approved April 18, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

BINGHAMTON, N. Y.—Taxpayers of Binghamton at a special election voted in favor of issuing $148,200 bonds for the erection of a municipal street lighting plant.

CAMDEN, N. J.—The Keystone Leather Company is planning for the erection of a new boiler and engine plant on Stevens Street. A.

JERSEY CITY, N. J.—The Merchants' City Centre Association is negotiating with the Board of City Commissioners for the installation of an ornamental street lighting system on Newark Avenue, in the vicinity of the "Five Corners." A.

TRENTON, N. J.—The American District Telegraph & Messenger Company has made application to the Board of City Commissioners for the operation of a local fire alarm, signal and messenger system, lines of existing companies to be used where possible.

MILESBURG, PA.—The State Centre Electric Company will move its power plant from Bellefonte, Pa., to Milesburg, where waterpower will be used instead of steam for generating electricity. S.

SOUTH ATLANTIC STATES.

CUMBERLAND, MD.—It is reported that the Hagerstown & Frederick Railway Company has arranged to purchase the Frostburg Illuminating & Manufacturing Company, which supplies electricity to Frostburg and vicinity. It is also negotiating for a water power development of 50,000 horsepower capacity near Cumberland. The company is still undecided whether to buy this development or to build a large power plant at Cumberland and furnish the current through transmission lines to its customers in Allegany County. With the consummation of these deals, on which the counsel for the company is now at work, the company will occupy the public service field in the whole of the Western Maryland counties.

MENDOTA, VA.—This city is figuring on installing an electric lighting system. J. C. Payne is mayor. G.

WASHINGTON, N. C.—June 17 bids will be received for improving the electric light plant. $150,000 in bonds has been authorized. Address Frank C. Kugler, mayor.

BATESBURG, S. C.—The J. B. McCrary Company, Atlanta, Ga., is preparing plans for an electric light plant.

REYNOLDS, GA.—The City is planning to establish an electric light plant. Address G. L. Cooper, secretary, for further information.

NORTH CENTRAL STATES.

ATHENS, O.—July 18 has been set by the local council body as the date for an election to decide upon the proposed issuing of $118,000 in bonds for a new light plant and water works. Of this amount $45,000 will be for the light plant. J.

BELLEFONTAINE, O.—A franchise has been granted to George Lehrer for an electric lighting plant at Rushsylvania. Work on the plant it is stated will begin at an early date. H.

DAYTON, O.—The Carrmonte Improvement Association, of the village of Carrmonte, near here, is in charge of the project of securing electric lights for the village, and it is reported that the installation will be made within the next month or so. L.

GREENVILLE, O.—The Greenville Electric Light & Power Company has taken the preliminary steps for a $28,000 common stock increase, the proceeds to be used in building and equipping an addition to its power station here. J.

MASON, O.—$14,000 will be expended for municipal lighting. Address the village clerk.

YOUNGSTOWN, O.—H. W. Jones, lighting expert of Cleveland, has been employed to make preliminary plans for a municipal lighting plant for the city of Youngstown and also to devise and draw up plans for a new lighting system for the city. H.

HAVANA, ILL.—The Commercial Club is planning ways and means to establish ornamental lighting. Address the secretary.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company will spend $2,000,000 in Minneapolis in the coming year in general improvement work and extension of service. The work will consist of laying of new ducts and conduits to connect the Main Street, S. E., and Fifth Street Stations; replacing of Fifth Street station machinery and enlargement of capacity.

PINE RIVER, MINN.—The Pine River Electric Company will build a transmission line to Backus.

SPRINGFIELD, MINN.—George P. Foster was chosen chairman of a committee to look up the matter of a "White Way" lighting system.

PRIMGHAR, IOWA.—Electric lights will be installed here. Address the city clerk for particulars.

WELLMAN, IOWA.—The Council has granted a franchise to a private company to establish a lighting plant. Address the village clerk.

BRUNSWICK, MO.—J. A. Nickell & Sons, operating the Brunswick electric light plant and waterworks, will spend about $5,000 for new equipment. A new 75-horsepower Murray engine of the Corliss type already has been ordered. The installation of new machinery will make possible a 24-hour service for both light and power. M.

CASSVILLE, MO. — Farmers of Barry County will establish a telephone system with headquarters at Cassville, as the result of a disagreement with the Mitchell, Kans., Telephone & Electric Company. M.

ARMOUR, S. D.—Interstate Power Company will locate a central plant here with J. F. Cameron as manager. C.

DE SMET, S. D.—Lake Preston Milling Company will erect a plant here and supply the town with electricity. C.

KANSAS CITY, KANS.—The municipal authorities will manufacture ice at the municipal light plant. About $200,000 will be spent for equipment. L. H. Chapman is commissioner of water and lights. M.

MANHATTAN, KANS.—The City Commissioners have begun negotiations with the view of purchasing the electric light plant of the Manhattan Ice, Light & Power Company. M.

ROBINSON, KANS.—The Council at a recent meeting decided to abandon the idea of installing a municipal electric light plant, and the project has been taken up by H. J. Stockings, who has asked the city for a franchise.

SOUTH CENTRAL STATES.

CADIZ, KY.—The city's second electric light franchise was sold here to George L. Smith, who will erect a plant. A previous franchise was sold to Alexander Brothers & Comapny, and that concern has contracted for the lighting of a number of residences. G.

MUNFORDVILLE, KY.—A new electrical concern is the New Munfordville Electric Light & Power Company, incorporated here with a capital of $2,800. F. W. Wheeler, J. W. Payton, J. M. Craddock and Richard Lobb are the incorporators. G.

BRISTOL, TENN.—Abingdon, Va., has contracted with the Bristol Gas & Electric Company for street lighting and power. The electricity will come from the Watauga power plant. G.

CHATTANOOGA, TENN.—Bids for a five-year contract for lighting the city's streets have been advertised for, according to approved specifications. The contract with the Chattanooga Railway & Light Company will expire in December. G.

NASHVILLE, TENN. — Lyle Andrews, commissioner of lights, has under consideration a petition from the property owners along Eighth Avenue between Church and Broadway, for the placing of cluster-globe-lighting standards along that part of the street as has been done already in other sections of the down town streets of Nashville. It is reported that he and the property owners have virtually reached an understanding as to the apportionment of the expense.

BROWNSVILLE, TEX.—Albert A. Browne and associates, who have just purchased the Rio Grande Railroad that runs from Brownsville to Point Isabel, 22 miles, and the local street railway system, will construct an electric power plant for the purpose of providing energy for operating the combined system.

WESTERN STATES.

LIVINGSTON, MONT.—Work will begin in the immediate future on the installation of automatic electric block system on the Northern Pacific Railroad, between this city and Toston, also on the reconstruction of all telegraph and telephone lines between this city and Missoula. The block-signal installation extends over 195 miles of roadway. O.

POTTER, WYO.—C. C. Carlisle, of Cheyenne, has prepared plans for a municipal lighting plant. Address the city clerk.

BOISE, IDAHO.—The receiver of Idaho-Oregon Light & Power Company has secured permission from the Federal Court to continue construction of the 5,000 horsepower Oxbow Plant on the Snake River, near here. He will spend $220,000 in completing the plant. Over $1,000,000 has already been spent on this project, and it is planned at a later date to construct a dam and develop 32,000 horsepower.

SAFFORD, ARIZ.—The plant of the Gila Valley Light, Power & Water Company, only recently completed, has been destroyed by fire.

TUCSON, ARIZ.—Monte Mansfield, of Tucson, and Spiro S. Proto, of Nogales, have been granted an electric light franchise for Nogales.

EVERETT, WASH.—D. A. Barnes, manager of the Everett Railway, Light & Water Company, has petitioned the County Commissioners for a franchise to construct and operate electric transmission lines from the interurban road to Beverly Park, where the Florida Land Company has announced its intentions of installing an electric lighting system. O.

MONROE, WASH.—The Monroe Water & Light Company is negotiating with Seattle capitalists for the sale of the local plant, who, it is understood, will invest a large sum of money in improvements. O.

PORTLAND, ORE.—Preparatory to the establishment of a municipal lighting plant in this city, to furnish light and power for all the city streets, buildings, shops, and parks, and possibly to enter into the sale of current for commercial purposes, City Commissioner Daly has asked the City Council to uphold him in the appointment of an electrical engineer to make a detailed investigation of the cost and feasibility of such a plant on one of two power sites, which the Council has under consideration and which belong to the city. Under budget appropriation, the city has $5,000 available for the investigation Each of the sites has a capacity, under proper development, of 30,000 horsepower.

TILLAMOOK, ORE.—The City Council has granted a 25-year franchise to the Tillamook Light & Fuel Company, which contemplates numerous improvements.

BANNING, CAL.—The Board of City Trustees has sold a blanket franchise to Ghreist & Son of Newport Beach, Cal., who will proceed to install an electric light and power system in Banning. Electricity will be supplied by the Southern Sierra Power Company. The same company is planning to operate lighting plants in Victorville and other neighboring towns with Banning as headquarters.

LOS ANGELES, CAL.—It is announced that the City will purchase a sufficient amount of the $6,500,00 issue of power bonds voted on May 8 to permit work to be resumed as soon as possible. Plans for more than doubling the amount of water saved by the aqueduct have been announced by Councilman Betkouski, chairman of the public service committee after a trip of inspection, by means of constructing a large dam across the mouth of the Owens River gorge where it opens into Long Valley. The dam is estimated to cost $200,000, and it is to be built by the water department.

NORDHOFF, CAL.—The Ojai Power Company has applied to the Railroad Commission for authority to issue 192 shares of its capital stock at the par value of $19,200. The funds are to be used for the installation of an additional unit for the distribution of power for lighting purposes in this vicinity.

SAN BERNARDINO, CAL.—The Southern California Edison Company has been granted a franchise to construct transmission lines along certain highways in San Bernardino County.

VALDEZ, ALASKA.—Amended articles of incorporation for the Alaska Water, Light & Power Company, of this city, have been filed with Secretary of the Territory, Charles E. Davidson. Amended articles show that the capital stock has been increased from $100,000 to $250,000. S. A. Hemple, of Valdez, is the head of the company, and is authority for the statement that considerable work of improvement and extensions will be made during the coming summer. O.

PROPOSALS.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C. until July 10 for the lighting fixtures for the post office at Idaho Falls, Idaho. Drawings and specifications may be obtained from the custodian of the site or the office of the Supervising Architect.

ELECTRIC ELEVATORS. — Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 26 for two electric passenger elevators for the post office at Dayton, O., in accordance with drawings and specifications, copies of which may be obtained from the office of the Supervising Architect.

ELECTRIC WORK. — Sealed proposals will be received until June 18 by the Board of School Directors, Ben Avon, Pa., for the general contract on electric work. Plans and specifications for the work and all necessary information upon which the bids are to be based, may be obtained at the office of R. M. Trimble, architect, 705 Ferguson Building, Pittsburgh, Pa. S.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 23 for furnishing 20 panels, for delivery at the Navy Yards, Boston, Brooklyn, Norfolk and Charleston; and 20,000 feet of leaded and armored steel twin-conductor wire, for delivery at the Navy Yard, Brooklyn, N. Y., both as per Schedule 6886.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 16 for furnishing four hot-wire ammeters; 4,500 feet armored double-conductor wire; miscellaneous magnet wire, as per Schedule 6856, for delivery at the Navy Yard, Brooklyn, N. Y.; and 16,000 feet of rubber-covered wire, as per Schedule 6855, for delivery at the Navy Yard, Brooklyn, N. Y The Bureau will also receive bids on the following until June 30: Two 200-kilowatt generating sets, as per Schedule 6878, for delivery at the Navy Yard, Philadelphia, Pa.; miscellaneous three-conductor potheads; miscellaneous switches and panels; 470 feet three-conductor wire; 880 pounds bare copper wire, as per Schedule 6861, for delivery at the Navy Yard, Philadelphia, Pa., and until July 14 for miscellaneous generating sets and spare parts, as per Schedule 6851, for delivery at the Navy Yard, Mare Island, Cal.

FOREIGN TRADE OPPORTUNITIES.

[Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., and at the branch offices of the Bureau, 315 Customhouse, New York, 629 Federal Building, Chicago, Ill., Association of Commerce Building, New Orleans, La., and 310 Customhouse, San Francisco, Cal. Apply for addresses in letter form, giving file numbers.]

NO. 13,110. ELECTRIC CRANES.—The American consulate at Madrid, Spain, reports that the acquisition of two electric cranes for use in the port of Huelva, Spain, is authorized. Proposals must be submitted through a local representative before June 27.

NO. 13,113. ELECTRIC MASSAGE VIBRATORS.—The manager of an important barber shop in a European capital informs an American consular officer that he desires to receive catalogues from American manufacturers of electric massage vibrators. Correspondence may be in English.

NO. 13,129. NOVELTIES AND ELECTRIC HOUSEHOLD UTILITIES.—An American consul reports that a resident of a European city desires to import American novelties of all kinds, including electric household utilities. Correspondence should be in German.

NO. 13,164. ELECTRIC CRANES.—The American consulate at Madrid, Spain, reports that proposals are requested by the Junta de las Obras del Puerto de Valencia, Valencia, Spain, for supplying and installing in the port of Valencia, four electric cranes. The estimated cost of the cranes is not stated. Proposals must be submitted through a local representative before July 19.

NO. 13,166. FIRE-ALARM SYSTEM.—An American consular officer reports that the municipal authorities in a city of his district are considering the installation of a fire-alarm system for the city. Advertising literature, full particulars, and prices should be sent to a list of persons named in the report by the consul.

NO. 13,178. ELECTRIC CRANE.—A report from an American consul states that in about two months some harbor improvements in his district will be completed and the Government proposes to erect an electric crane for handling cargoes. No details are available, but the installation will probably be made by the contractors in charge of the improvements. Interested American manufacturers should lose no time in placing illustrated circulars in their hands, and prices should be quoted c. i. f. certain city. Letters and advertising matter should be in the Italian language.

FINANCIAL NOTES.

At the annual meeting of the Mexican Telegraph Company retiring directors were re-elected.

At the annual meeting of the Central & South American Telegraph Company, retiring directors were re-elcted.

The Philadelphia Company has elected George S. Davidson to the Board of Directors, succeeding Patrick Calhoun.

The Consumers Power Company, of Minnesota, is offering, through H. M. Byllesby & Company, $64,000 of three and one-half-year six-per-cent collateral notes, dated November 1, 1913, at 98 and interest.

Hambleton & Company, of Baltimore, are offering the unsold portion of $1,000,000 consolidated four-per-cent bonds of the Washington Railway & Electric Company, due 1951, at 83.5 to yield about five per cent.

Bondholders of the Rochester Telephone Company have ratified the plan to surrender interest on their holdings for two years in order to raise $200,000 for new equipment and extensions.

The California Railroad Commission has extended to December 31, 1914, the time in which the Great Western Power Company may issue and dispose of the $3,971,731 first-mortgage five-per-cent sinking-fund bonds, authorized by the commission some time ago. The time originally fixed called for the issue to be made prior to March 1, 1914.

At the special meeting of the American Gas & Electric Company, stockholders voted to increase the capital stock of the company by authorizing $500,000 additional common stock, with par value of $50. All common stock authorized by the previous increase in capital has been allotted to stockholders and the new stock will remain as treasury stock until such time as the board of directors approve its distribution to common shareholders.

The Federal Light & Traction Company will complete in the current year a comprehensive program of improvements calling for a total expenditure of $7f1,000. Since its organization in 1910 the company has expended directly and through its subsidiaries upward of $10,000,000 in the purchase and development of public utility properties.

The Pacific Gas & Electric Company, in a letter to stockholders, requests approval of a charter amendment to reclassify capital stock into $100,000,000 common, $50,000,000 first preferred and $10,000,000 present preferred, making a total of $160,000,000. Offers to stockholders of an issue of $12,500,000 new preferred at $82.50 permits holders of old $10,000,000 preferred to exchange for new preferred after July 1, 1916, at the rate of ten and one-quarter shares new for ten shares of old. Dividends of four per cent on the common stock will be resumed in 1915.

The Twin City Rapid Transit Company will offer to its preferred and common shareholders of record June 15, the right to subscribe pro rata up to July 15, to $1,900,000 par value of the unissued capital stock of the company at par. This gives both the preferred and common shareholders the right to take one share of new common stock for each twelve shares of the present holdings. The stock will be payable 20 per cent at the time of the suoscription on or before July 15. The balance is payable in installments of 20 per cent each sixty days thereafter. Interest at six per cent will be allowed on all payments made and the right to prepay in full is granted. Interest and dividends will be adjusted at the time of any prepayment.

The Western States Gas & Electric Company is offering, through H. M. Byllesby & Company, $50,000 first and refunding five-per-cent bonds at 89 and interest or on a 5.80-per-cent basis. There are now $4,392,000 of these bonds outstanding in addition to $418,000 American River Electric five-per-cent first-mortgage bonds. Earnings of the company for the year ended March 31 last were $1,082,457 gross, $476,665 net and $256,613 balance after fixed charges, including interest on the additional issue. The American River Electric bonds cover a hydroelectric plant on the American river.

The Columbus Railway, Power & Light Company has called a special meeting of stockholders for June 29, at Columbus, Ohio, to authorize the issue of $3,145,000 four-per-cent prior-preference stock. The new stock is to be issued solely for the purpose of taking up and retiring in whole or in part, with the consent of the bondholders, the $3,145,000 outstanding first-consolidated-mortgage 40-year four-per-cent bonds of the Columbus Railway Company, dated October 2, 1899, and due October 1, 1939. The approval also will be asked of an issue of $450,000 Series A six-per-cent preferred stock, to take up and retire the $450,000 six-per-cent first-mortgage 25-year bonds of the Columbus Electric Company, dated November 1, 1897. The stockholders will be asked to approve an increase in the capital stock of Columbus Railway, Light & Power Company from $11,550,000 to $15,145,000, including the above issue of prior-preference four-per-cent stock and six-per-cent Series A preferred stock. The stockholders also will be asked to approve an issue of first and refunding sinking-fund five-per-cent bonds of an authorized amount not to exceed $25,000,000, such bonds to be issued from time to time upon the consent of the Ohio Public Utilities Commission for the acquisition of properties, the construction, completion, extension or improvement of its facilities, for refunding outstanding bonds or for other corporate requirements. On account of the special meeting the transfer books of the company will be closed from June 14 to June 29. The issue of the new stocks and creation of the new mortgage is for the purpose of enabling the company to simplify its capitalization and also to formulate a plan for the raising of additional capital.

Dividends.

	Term.	Rate.	Payable.
Brazil Tr., Lt.&Pwr.pf.	Q	1.5	July 1
Cent. States Elec. pf.	Q	1.75	July 1
Col. Elec. pf.	Q	3.	July 1
Duluth-Supr. Tr. pf.	Q	1.	July 1
Duluth-Spr. Tr. com.	Q	1.	July 1
East. Pow. & Lt.	Q	1.5	June 15
El Paso Elec. pf.	S-A	3.	July 13
Indianapolis St. Ry.	S-A	3.	July 1
Interborough R. T.	Q	2.5	July 1
Louisville Trac. com.	Q	1.	July 1
Manila El. R. R. & L.	Q	1.75	July 1
Niagara Falls Pow.	Q	$2.	July 15
N. Y. State Rys. pf.	Q	1.25	July 1
N. Y. State Rys. com.	Q	1.5	July 1
Penn. Wat. & Pow.	Q	1.	July 15
Phila. Co.	Q	1.75	Aug. 1
Phila. Co. pf.	S-A	2.5	Sept. 1
Un. Tr. & Elec. N. J.	Q	1.25	July 1
Union Tr. Phila.	S-A	3.	July 1
Western Elec.	Q	2.	June 30

Reports of Earnings.

AMERICAN POWER & LIGHT.

(Combined earnings of subsidiary companies.)

	1914.	1913.
April gross	$ 524,627	$ 459,310
Expenses and taxes	279,315	266,906
Net earnings	245,312	192,404
Twelve months' gross	6,112,059	5,458,356
Expenses and taxes	3,274,683	3,048,024
Net earnings	2,837,376	2,410,332

NORTHERN OHIO TRACTION & LIGHT.

	1914.	1913.
April gross	$ 287,719	$238,546
Net	114,397	83,926
Surplus after charges	64,066	38,712
Four months' gross	1,080,884	925,727
Net	412,582	343,321
Surplus after charges	212,427	163,025

MONTREAL LIGHT, HEAT & POWER COMPANY.

The Montreal Light, Heat & Power Company has issued its report for the year ended April 30, 1914. The income account compares as follows:

	1914.	1913.
Gross	$6,245,697	$5,509,557
Expenses	2,778,451	2,328,440
Net	3,467,246	3,181,116
Interest	467,977	463,979
†Surplus	2,999,269	2,717,137
Dividends	1,700,000	1,530,000
Surplus	1,299,269	1,187,137
*Deductions	610,000	560,000
Surplus	689,269	627,157

*Depreciation and pension fund.
†Equal to 16.74 per cent on $17,910,662 capital stock, as against 15.98 per cent on $17,000,000 previous year.

SOUTHERN CALIFORNIA EDISON.

	1914	1913
April gross	$ 376,337	$ 369,971
Net earnings	166,651	187,952
Gross income	177,156	187,893
Surplus after charges	98,248	119,840
Balance after depreciation	73,248	54,840
Four months gross	1,522,984	1,478,909
Net earnings	692,051	705,264
Gross income	704,175	704,452
Surplus after charges	402,947	431,600
Balance after depreciation	302,947	216,600

INTERBOROUGH RAPID TRANSIT.

	1914	1913
April gross	$3,020,204	$2,850,646
Net after taxes	1,774,879	1,559,088
Other income	37,239	55,027
Total income	1,812,118	1,614,115
Surplus after charges	904,740	672,007
Passengers carried	58,845,286	55,729,197
Ten months gross	27,851,791	27,049,525
Net after taxes	15,379,515	14,274,287
Other income	501,473	371,942
Total income	15,880,988	14,646,228
Surplus after charges	6,581,146	5,429,309
Nine months dividends	2,625,000	2,265,000
Surplus	3,956,146	2,804,309
Passengers carried	542,994,759	527,933,490

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 8	June 1
American Tel. & Tel. (New York)	123¼	122½
Commonwealth Edison (Chicago)	135½	135
Edison Electric Illuminating (Boston)	250	252
Electric Storage Battery common (Philadelphia)	52	52
Electric Storage Battery preferred (Philadelphia)	52	52
General Electric (New York)	148	148¾
Kings County Electric (New York)	120	120
Massachusetts Electric common (Boston)	11⅛	11½
Massachusetts Electric preferred (Boston)	58⅝	58
National Carbon common (Chicago)	110½	110½
National Carbon preferred (Chicago)	118	117½
New England Telephone (Boston)	134	134½
Philadelphia Electric (Philadelphia)	25⅝	25½
Postal Telegraph and Cables common (New York)	81¾	82
Postal Telegraph and Cables preferred (New York)	68½	68½
Western Union (New York)	61⅝	61⅞
Westinghouse common (New York)	76½	77
Westinghouse preferred (New York)	124	123

PERSONAL MENTION.

MR. W. H. CLARKE has been appointed manager of the Bond Department of H. M. Byllesby & Company, Chicago.

PROF. COMFORT A. ADAMS, of Harvard University, has been made Abbott and James Lawrence professor of engineering.

MR. HARLEY ROBINSON, electrical engineer at the American gypsum plant, Gypsum, O., had his right leg broken and his right arm badly bruised last week when he was knocked from his bicycle by a motorcycle.

MR. FRED A. POOR, Chicago, representative of The Rail Joint Company, resigned on June 1 to become president of the P. & M. Company, whose general offices are in the Railway Exchange Building, Chicago.

MR. RICHARD HAWKEY, of Pittsburgh, Pa., who has been assistant to the vice-president of the Eastern Group of the Bell Telephone Company, has been appointed vice-president and general manager of the Pittsburgh & Allegheny Telephone Company.

MR. FRANK C. HULING, of Columbus, O., has been made treasurer of the Pittsburgh & Allegheny Telephone Company, which has just emerged from the hands of a receivership of three years' standing. Mr. Huling fills the vacancy caused by the death of Mr. J. W. Vance, of Wheeling, W. Va.

MR. ARTHUR PURDON has been engaged as assistant in the sales department of the Moloney Electric Company, St. Louis, Mo. He was formerly with the Westinghouse Electric & Manufacturing Company, serving in the transformer department and the consulting division of the engineering department at East Pittsburgh, and later in the St. Louis office of the company.

MR. HAROLD ALMERT, consulting engineer, Chicago, Ill., has been retained as technical counsel by the Washington Railway & Electric Company and the Potomac Electric Power Company, of Washington, D. C. The appraisal division of Mr. Almert's staff will make a detailed inventory and valuation of the property of these companies in preparation for a hearing before the Public Utilities Commission, which Commission appeared before the District Committee of Congress, on June 2, and declared itself in favor of public ownership of the utilities.

MR. L. R. POMEROY has been appointed manager of the New York sales office of The United States Light and Heating Company. Mr. Pomeroy has long been engaged in work in the railway and electrical fields, and enjoys the reputation of being an authority along several lines in each industry. He was born at Port Byron, N. Y., in 1857, and attended high school at Milwaukee, Wis., and the Irving Institute at Tarrytown, N. Y. From 1874 to 1880 he was engaged in commercial business, bookkeeping, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company of New York. For four years following this he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company, jointly. From 1899 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads, railway shops, and the general application of electricity for

L. R. Pomeroy.

all railway purposes. Following this he was for two years assistant to the president of the Safety Car Heating & Lighting Company, during which period he devoted a portion of his time to consulting work in the special field of railway shops and machine-tool operation. From there he went to J. G. White & Company as chief engineer of the railway and industrial division. Recently he has had an office in New York City as consulting engineer.

MR. W. A. THOMAS, who for several years has been commercial engineer in charge of all sales of mining apparatus for the Westinghouse Electric & Manufacturing Company, resigned his position with this company on June 1, and has taken up the practice of consulting engineering in Pittsburgh, with offices in the Second National Bank Building. He will specialize on mining. Mr. Thomas

W. A. Thomas.

graduated from Pennsylvania State College in 1898 and was connected with the General Electric Company at Schenectady, going through the Testing Department and being afterwards connected for several years with the Power and Mining Engineering Department. For two years he was in charge of the power equipment of the Pennsylvania Coal and Coke Company at Cresson, Pa., resigning his position with this company to take charge of the mining work of the Westinghouse Electric Company. Mr. Thomas is also president of the Rocky Ridge Coal Company, of Robertsdale, Pa., which is an important bituminous coal-mining company.

OBITUARY.

MR. WILLIAM R. BELKNAP, chairman of the Board of Directors, formerly president and one of the founders of the Belknap Hardware & Manufacturing Company in Louisville, died at his home there on May 31. He was 65 years of age and was at the head of one of the largest concerns distributing electrical supplies in the country.

MR. EDWARD BRILL, a member of the firm of J. G. Brill Company, street-car builders of Philadelphia, Pa., died at his summer home near Atlantic City, N. J., on June 8, at the age of 64. Mr. Brill was the son of one of the founders of the company and had held every official position in the company except that of president.

MR. ALEXANDER E. ORR, for many years president of the Board of Rapid Transit Railroad Commissioners, in New York City, died on June 3, at his home in Brooklyn, at the age of 83 years. The Public Service Commission for the First District adopted a minute in appreciation of the work of Mr. Orr in connection with the rapid-transit subway facilities of New York City.

MR. JACOB FURTH, president of the Puget Sound Traction, Light & Power Company, died in Seattle, Wash., recently. Mr. Furth was born November 14, 1840, in Austria. He came to this country in 1858, going first to California. He afterwards settled in Seattle and became interested in a number of business enterprises in that city. At the time of his death he was interested in several banks, holding large interests in real estate and other lines of business. When the Seattle Electric Company was formed he was made president.

NEW INCORPORATIONS.

EAST LIVERPOOL, O.—The E. J. Bett Lighting Company has been organized with a capital stock of $10,000, to deal in light fixtures. The incorporators are E. J. Bett, G. A. Hughes, K. J. J. Hughes, and others. L.

TRENTON, N. J.—MacLewee Electrical Company has been incorporated to deal in electrical supplies. The capital stock of the company is $100,000 and the incorporators are W. MacLewee, H. M. Hartman and F. R. Brace, of this city.

BINGHAMTON, N. Y. — Mason-Bouck Electric Company, Incorporated, has been granted articles of incorporation, capitalized at $5,000, to engage in the business of electrical work, electrical fixtures, etc. The incorporators are Elizabeth Mason, Fred J. Mason and William C. Bouck, all of this city.

CHICAGO, ILL.—Becker Brothers, of Chicago, have been granted a license to incorporate. The capital stock is given as $25,000 and the incorporators are Oliver E. Becker, Charles J. Becker and William F. Becker. The company is to manufacture and deal in motors, dynamos, electrical apparatus, etc. Z.

DATES AHEAD.

American Society of Mechanical Engineers. Spring meeting, St. Paul, Minn., June 16-19. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York, N. Y.

American Institute of Chemical Engineers. Sixth semi-annual meeting, Troy, N. Y., June 17-20. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

Michigan Section, National Electric Light Association. Annual convention cruise leaving Detroit June 17, for the Thousand Islands and intermediate points, returning June 20. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Electrical Contractors' Association of the State of Illinois. Annual meeting, Danville, Ill., June 19-20. Secretary M. N. Blumenthal, 179 West Washington Street, Chicago, Ill.

Minnesotal Electrical Contractors' Association. Annual convention, St. Paul, Minn., June 22. Secretary, G. M. Jones, 14 North Seventh Street, Minneapolis, Minn.

American Institute of Electrical Engineers. Thirty-first annual convention, Cadillac Hotel, Detroit, Mich., June 23-26. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

Canadian Electrical Association. Annual convention, Montreal, Canada, June 24-26. Secretary, H. G. Martin, Toronto, Ont.

American Society for Testing Materials. Seventeenth annual meeting, Atlantic City, N. J., June 30-July 4. Secretary, Edgar Marburg, University of Pennsylvania, West Philadelphia, Pa.

National Electrical Contractors' Association of the United States. Annual convention, Cadillac Hotel, Detroit, Mich., July 15-18. Secretary, G. H. Duffield, 41 Martin Building, Utica, N. Y.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 21-24. Secretary, D. L. Gaskill, Greenville, O.

New England Section of the National Electric Light Association. Sixth annual convention, Narragansett Pier, R. I., September 2-4. Secretary, Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, Albert Jackson Marshall, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

Gleason-Tiebout Glass Company, New York City, has issued a card calling attention to its line of Onyx lighting glassware.

General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y., announces that Frederick Steinberger has been appointed sales manager for its middle west territory, with an office at 9 South Clinton Street, Chicago, Ill.

General Chemical Company has begun work on its new plant at Newell, Pa. The building will be used for the manufacture of muriatic acid. It will cost $250,000, bringing the total valuation of the company's holdings at Newell up to $2,000,000. F. W. Lovejoy is superintendent.

The Thompson Electric Company, Cleveland, O., has recently issued a pamphlet describing Thompson cut-out hangers for incandescent and arc lamps. These hangers are designed to permit the ready and safe cleaning of lamps and reflectors by rendering the lowering and the disconnecting of a lamp an easy matter.

The Ohio Brass Company, Mansfield, O., has issued its 1914 catalog of appliances used in the construction, maintenance, and operation of electric-railway systems, mine-haulage systems and transmission lines. This catalog contains 600 pages and includes numerous cuts of the various devices described.

The F. W. Wakefield Brass Company, Vermillion, O., has issued its 1914 catalog of lighting fixtures. This catalog covers numerous types of plain and ornate direct, semi-indirect and indirect fixtures. Numerous cuts and full descriptions add to the value of the catalog. In addition to describing numerous types of lighting fixtures, fixture parts and devices are included.

H. W. Johns-Manville Company has moved its Duluth, Minn., office to larger quarters at 327 West First Street, in order to take care of its increased business. The new office is on the ground floor, with windows for the display of J-M asbestos roofing, pipe coverings, packings, sanitary specialties, automobile accessories and other products of this company's well known and varied lines.

Mesta Machine Company, Pittsburgh, Pa., has ready for distribution Bulletin O which deals with Mesta rope drives. This publication points out some of the advantages of rope drives and shows numerous typical installations thereof. The factors on which the success of a rope drive depend are clearly set forth and valuable diagrams and formulas are given for determining the life of Manila transmission rope.

De La Vergne Machine Company, New York City, has issued a folder entitled, "One Cubic Inch of Oil with 6,000 Square Inches of Surface," calling attention to the principles and advantages of De La Vergne oil engines.

Harrison Safety Boiler Works, Philadelphia, Pa., has recently issued a booklet on "Precision in the Measurement of Water," which describes various types of instruments for use in steam power plants.

Ft. Wayne Electric Works, of General Electric Company, Fort Wayne, Ind., has issued bulletin No. 46,203, which describes and illustrates its new type-K5 single-phase watt-hour-meters. These meters are of exceptionally simple construction, compact size and light weight, but maintain the standard for accuracy and reliability characteristic of the meters built by this establishment. The bulletin is well illustrated with general and detail views and diagrams.

The H. A. Strauss Data-Card Service, Harris Trust Building, Chicago, Ill., has begun the fortnightly publication of a continued series of engineering data cards. These will cover the entire field of engineering and related technical subjects. The cards are 5 by 8 inches in size, conveniently arranged for filing, and are etchings of specially prepared data sheets and diagrams, all neatly lettered. They are live and of high engineering value. A simple system of indexing has been adopted. Eight or more cards are to be issued each month.

Babcock & Wilcox Company, New York City, has published a sixty-three page book entitled "Chain-Grate Stokers." This publication is fully up to the standard set by this company in the completeness and excellence of the illustrations. The stokers are described in detail with the aid of numerous diagrams. Sectional views are shown of the use of the stokers with various types of boilers. There are a large number of illustrations of complete installations. The book contains much valuable information, including tests relating to stoker equipments, etc.

International Electric Tool Company, Fourth and Windlake Avenues, Milwaukee, Wis., announces that its secretary and treasurer, William H. Gaulke, has withdrawn entirely from his former connection with the Independent Electric Manufacturing Company, of which he was treasurer. Mr. Gaulke will now devote himself entirely to the interests of the International Company, developing a complete line of electric hammers, riveters and chippers for stone and iron. Recently, he developed a set of electric vibrators for use in foundries.

C. C. Bohn Electric Company, 780 Sixth Avenue, New York City, has been appointed exclusive sales agent for the sale of the Santo electric vacuum cleaners for the territory of Greater New York and vicinity, by the **Santo Manufacturing Company,** of Philadelphia, Pa. The Bohn company has also acquired the business of the **Santo Electric Appliance Company,** formerly at 168 Madison Avenue, New York City. The acquisition of the Santo line, together with the steady growth of its supply and contracting business has caused the Bohn company to secure a long

lease of the building at 820 Sixth Avenue, New York City, where extensive alterations are being made. The company will probably move into its enlarged quarters on or about August 1, 1914.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued "Textile Quarterly No. 7," which deals with the equipment of power plants for textile mills. Construction and operation of steam turbines are thoroughly explained and illustrated, and the advantages of that method of drive for industrial plants are clearly set forth. Several tables are devoted to figures showing the comparative cost of installation of reciprocating engines, low-pressure and high-pressure turbines, and high-pressure turbine with bleeder. Porcelain and glass insulators are described and illustrated in catalog section No. DS845, just issued by the company. The booklet gives a large number of sectional drawings with the voltage ratings. The different kinds of insulators such as the pin type for poles, pin-type strain insulators, transformer bushings, roof-entrance bushings, outdoor-type transformer bushings, floor and wall tubes and knobs are all covered.

General Electric Company, Schenectady, N. Y., has received the following among a large number of recent orders for power equipment: Empire District Electric Company, Joplin, Mo., two 300-kilowatt synchronous converters, one 210-kilovolt-ampere frequency-changer set, three 500-kilovolt-ampere water-cooled transformers, six 110-kilowatt and three 75-kilowatt transformers, switchboards and accessories. Eastern Michigan Power Company, Jackson, Mich., three 900-kilowatt transformers. Roque River Public Service Corporation, Grant's Pass, Ore., has purchased a 750-kilowatt alternating-current generator. Aluminum Company of America, Massena, N. Y., eighteen 2,500-kilowatt rotary converters and nine 5,000-kilowatt water-cooled transformers. Cyclops Iron Works, San Francisco, Cal., has two 15, four 30 and four 37-horsepower induction motors. Crucible Steel Company, Milwaukee, Wis., one 500-kilovolt-ampere and three 10-kilovolt-ampere transformers. John A. Roebling's Sons Co., Trenton, N. J., fifteen 20-horsepower motors and starters. Riter-Conley Manufacturing Company, Pittsburgh, Pa., seven small motors, six motors of 10 horsepower and ten of 25 horsepower capacity. Oldbury Electric Chemical Company, Niagara Falls, N. Y., a 500-kilowatt rotary converter, three 175-kilovolt-ampere transformers and a switchboard. Lakeland Phosphate Company, Lakeland, Fla., a 937-kilovolt-ampere generator with 35-kilowatt turbo-exciter and 35-kilowatt motor-generator exciter set, switchboard and accessories. Portland Flouring Mills Company. Tacoma, Wash., a 500-horsepower induction motor with starting compensator panel, and two 100-kilovolt-ampere transformers. Standard Portland Cement Company, Leeds, Ala., four 75-horsepower induction motors. Spencer Kellogg & Sons, Buffalo, N. Y., a 1,000-horsepower induction motor and switchboard. Western Glass Company, Streator, Ill., two 200-horsepower induction motors and controllers. Newport Mill Company, Newport, Tenn., 25-horsepower, 35-horsepower and 75-horsepower induction motors. Bordens Condensed Milk Company, Elgin, Ill., a 150-kilowatt alternating-current generator, eight five-horsepower motors, switchboard and accessories. J. C. Hubinger Bros., Keokuk, Ia., a 1,270-horsepower synchronous motor with 18-kilowatt exciter; one 50, two 100 and one 150-horsepower induction motors, and switchboard and control apparatus. Western Brick Company, Danville, Ill., will install 7.5, 35 and 150-horsepower induction motors with compensators.

Record of Electrical Patents.

Issued by the United States Patent Office, June 2, 1914.

1,098,372. Telephone Apparatus. A. H. Dyson, assignor to Western Electric Co., Chicago, Ill. A battery signaling system.

1,098,379. System of Selective Control. J. H. Hammond, Jr., Gloucester, Mass. An electromagnet controlling apparatus operated by light waves.

1,098,380. Automatic Ticker Receiver. J. H. Hammond, Jr. Oscillation period of antenna varied by magnet-operated condenser.

1,098,387. Time Switch. V. G. Jensen, Chicago, Ill. A clock-operated knife switch.

1,098,431. Magneto-Electric Generator. R. H. Cunningham, assignor to Splitdorf Electrical Co., Newark, N. J. Special field and armature construction designed to deliver varying voltage.

1,098,436. Electric Heating System. W. S. Hadaway, Jr., New York, N. Y. Heating current supplied to reinforcing members of concrete building.

1,098,437. Electric Heating Device. W. S. Hadaway, Jr. Soldering iron with heating coil.

1,098,447. Calling Device. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Covers details of calling device for automatic telephones.

1,098,452. Inductor-Magneto Alternator. L. J. Le Pontois, New Rochelle, N. Y., assignor to H. W. Johns. Has permanent and electromagnetic field poles.

1,098,472. Indicating and Recording Hygrometer. W. H. Bristol, assignor to The Bristol Company, Waterbury, Conn. Has thermo-electric couples and voltmeter.

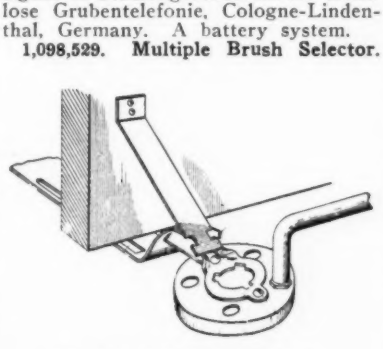
1,098,478. Attachment Plug for Electric Circuits. F. H. Chapman and O. E. Kenney, Toledo, O. A key plug.

1,098,490. Thermostatically Operated Circuit-Breaker. T. R. Fagan, Huntington, W. Va. Thermostat operates switch.

1,098,501. Electric-Wire Connection. H. H. Holdaway and A. C. Candland, assignors to M. E. Holdaway, Salt Lake City, Utah. A swivel connection.

1,098,528. Telephony and Telegraphy for Mining Cages. J. H. Reineke, assignor to Studiengesellschaft für drahtlose Grubentelefonie, Cologne-Lindenthal, Germany. A battery system.

1,098,529. Multiple Brush Selector.



1,098,581.—Outlet-Box Support.

J. N. Reynolds, assignor to Western Electric Co. An automatic switch.

1,098,539. Internal-Combustion Engine. J. A. Williams, assignor to The K. W. Ignition Co., Cleveland, O. Special ignition means for two-cycle engine.

1,098,545. Retractor for Printing-Telegraphs. A. H. Adams, assignor to Western Electric Co. A magnet-operated rotating shaft.

1,098,549. Transformer. T. E. Barnum, assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis. One winding is movable longitudinally.

1,098,550. Electric Welding Machine. F. E. Beam, assignor to The Electric Welding Co., Toledo, O. Covers details.

1,098,557. Rotary Converter. S. M. Burk, Philadelphia, Pa., assignor of one-half to G. W. Hosfeld. Armature composed of disks.

1,098,581. Support for Conduit Outlet Boxes. B. P. McKinley, assignor to Metal Specialties Co., Kansas City, Mo. For attachment to girder. (See cut.)

1,098,592. Illuminating Device. E. O. Schweitzer, assignor to Associated Engineers Co., Chicago, Ill. A cut-out for series lamps.

1,098,606. Electric Battery. E. Achenbach, Hamburg, Germany. Contains depolarizing mixture of graphite, manganese dioxide and mercuric oxide.

1,098,612. Elevation-Controlled Firing Apparatus for Guns. E. Bourdelles, Paris, France, assignor of one-half to Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Paris, France. Electric firing means.

1,098,617. Electrical Apparatus for Transmitting and Receiving Signals. A. T. Dawson and G. T. Buckingham, assignors to Vickers, Ltd., Westminster, England. Automatic telegraph receiving and sending apparatus.

1,098,628. Pistol Flash Light. H. Hyman, assignor to Interstate Electric Novelty Co., New York, N. Y. A flash-light toy.

1,098,637. Spark Plug. E. C. Rauch, Coeur d'Alene, Idaho. Has a carbon electrode.

1,098,649. Constant-Current Regulator. A. A. Tirrill, assignor to General Electric Co. An exciter regulator.

1,098,656. Alternating-Current Motor Control. E. F. W. Alexanderson, assignor to General Electric Co. Synchronous motor starts as single-phase commutator motor.

1,098,664. Instrument Transformer.

M. D. Dobrowolsky, assignor to General Electric Co. A bus-bar transformer.

1,098,666. Electric Brush. J. Graves, assignor to T. W. Lacey, Minneapolis, Minn. A wire brush connected to electric battery.

1,098,692. Temperature-Controlling Device for Storage Batteries. G. H. Stahl, assignor to The Stawil Co., Quincy, Ill. A thermometer-operated electromagnetic switch.

1,098,698. Electric-Railway Trolley. J. A. Walsh, Rochester, N. Y. A protecting device consisting of an auxiliary wheel.

1,098,705. Spark Plug. A. G. Bergstrom and A. J. Bergstrom, Rockford, Ill. Covers details.

1,098,717. Overhead-Trolley Construction. G. Gibbs, New York, N. Y. A pantograph.

1,098,718. Rheostat. A. I. Grabham, Wellington, New Zealand. A rheostat with special resistance block of manganese oxide, zinc oxide, soda silicate, and brass filings. (See cut.)

1,098,738. Lightning Rod. S. D. Krentzer, St. Louis, Mo. Covers details.

1,098,741. Electric-Lamp Push Socket. L. F. Lindstrom, assignor to Harvey Hubbell, Inc., Bridgeport, Conn. Covers details.

1,098,753. Electric Generator for Ignition Systems. E. Podlesák, Tiffin, O. Covers details of permanent magnet structure.

1,098,754. Inductor Alternator. E. Podlesák, Tiffin, O. Covers details of pole-fastening means.

1,098,761. Optical-Illusion Amusement Apparatus. C. I. Rehlin, Pittsburgh, Pa. A series of magnetically controlled figures.

1,098,772. Signal or Alarm Device. W. M. Waite, and J. H. Wheelock, assignors to American Model & Instrument Co. A clock-operated signal.

1,098,775. Bushing for Electric Tubular Insulation. C. M. Wheelock, assignor to The T.-W. Mfg. Co. A bushing for securing flexible tubing.

1,098,778. Circuit-Controller. H. P. Ball and G. Wright, assignors to General Electric Co. An electromagnetic switch.

1,098,779. Concealed-Wire Supporting Chain. W. H. Blake, assignor to F. S. Alden, Boston, Mass. Wires concealed in hollow chain.

1,098,780. Motor-Starting Device. P. Caldwell, assignor to General Electric Co. Includes electromagnetic contactors.

1,098,809. Railway Switch-Throwing Mechanism. H. C. Kinsel, Altoona, Pa. Electromagnetically operated.

1,098,822. Telephone Attachment. F. E. Miller, Fond du Lac, Wis. A special receiver support.

1,098,834. Electric Bell. S. Oliver, Chicago, Ill. An alternating-current bell.

1,098,842. Electric Sign. R. T. Savage, assignor to Savage Novelty Co., Inc. A transparent sign.

1,098,845. Elevator. M. C. Schwab, Chicago, Ill. Counterweight of safety device prevents motor rotation.

1,098,849. Switch. E. E. Smart and G. H. Hart, assignors to The Hart Mfg. Co., Hartford, Conn. A knob-operated switch. (See cut.)

1,098,852. Electric Permutation-Lock Switch. G. Stupar, Chicago, Ill. A special locking arrangement.

1,098,893. Electrically Operated Vibrator. J. L. Dinsmoor, New York, N. Y. A solenoid-operated vibrator.

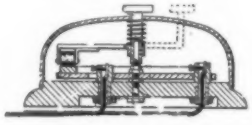
1,098,959. Telegraph Transmitter. L. I. Moore, Leggett, Tex. Has a number of levers controlling main contact.

1,098,867. Process of Making Insulating Material. C. F. Peterson, assignor to General Electric Co. Process of making mica sheet.

1,098,973. Electric-Lamp Socket. M. Reich, New York, N. Y. Covers details.

1,098,983. Electrical Musical Instrument. M. L. Severy, and G. B. Sinclair, assignors to Choralcelo Mfg. Co. Electromagnetically controlled.

1,099,022. Trolley Wheel. T. Cavanaugh, Pittsburgh, Pa. Designed to retain wheel on trolley wire.



1,098,718.—Rheostat.

1,099,061. Lamp Fixture. W. E. Lane, Kansas City, Mo. An adapter.

1,099,062. Electric Scalp Appliance. P. P. Laposkey, Cherokee, Iowa. A wire comb with battery attachment.

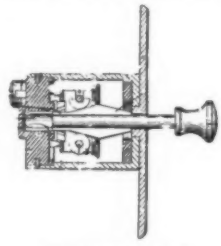
1,099,071. Rheostat. J. A. McCoy, Jr., assignor to Davis Electric Co., Parkersburg, W. Va. Covers details.

1,099,087. Lamp. E. A. Hawthorne, Bridgeport, Conn. Covers details of supports.

1,099,090. Terminal Device. W. G. Houskeeper, assignor to Westinghouse Lamp Co. A mercury contact.

1,099,091. Electrical Terminal Device. W. G. Houskeeper, assignor to Westinghouse Lamp Co. A modification of 1,099,090.

1,099,093. Electric Contact Device. A. Kent, Philadelphia, Pa. A ratchet and pawl contact device.



1,098,849.—Switch.

1,099,095. Process of Preparing Conducting-Filaments. H. D. Madden and W. G. Houskeeper, assignors to Westinghouse Lamp Co. Consists of applying electric currents of different values to portions of filaments.

1,099,138. Solid Titanium-Carbid Stick-Electrode. W. G. Abbott, Jr., assignor to General Electric Co. An electrode consisting of titanium carbid particles cemented together by titanium sub-oxid.

Re-issue 13,742. Original No. 920,350. Automatic Telephone-Exchange System. J. W. Lattig, and C. L. Goodrum, assignors to Western Electric Co. Covers details.

Patents Expired.

The following United States electrical patents expired June 8, 1914.

583,900. Electric Meter. J. Harris, Lynn, Mass.

583,912. Secondary or Storage Battery. A. S. Krotz, Springfield, O.

583,916. Searchlight Mount. F. T. Marchand and G. E. Marchand, Annapolis, Md.

583,926. Conduit. J. T. McRoy, Chicago, Ill.

583,933. Electric Motor. E. S. Pillsbury, St. Louis, Mo.

583,934. Shunt Ammeter. W. B. Potter, Schenectady, N. Y.

583,935. Series-Parallel Controller. W. B. Potter, and F. E. Case, Schenectady, N. Y.

583,936. Electric Furnace. E. F. Price, Niagara Falls, N. Y.

583,938. Pneumatic Controller. E. D. Priest, Schenectady, N. Y.

583,939. Pneumatically Actuated Controller. E. D. Priest and F. A. Merrick, Schenectady, N. Y.

583,944. Rotary Converter. E. W. Rice, Jr., Schenectady, N. Y.

583,945. Electric Light for Vehicles. A. M. Rodriguez, Brooklyn, N. Y.

583,950. Three-Phase Induction Meter. C. P. Steinmetz, Schenectady, N. Y.

583,951. Motor Meter. C. P. Steinmetz.

583,953. Apparatus for Producing Currents of High Frequency. N. Tesla, New York, N. Y.

583,955. Carbon Holder for Arc Lamps. E. Thomson, Swampscott, Mass.

583,956. Producing Sterioscopic Pictures by Roentgen Rays. E. Thomson.

583,957. Electrostatic Influence Machine. E. Thomson.

583,959. Safety Lamp. W. Waegel, Philadelphia, Pa.

583,963. Electric Switch. G. Winckler, Schenectady, N. Y.

583,987. Lightning Arrester. A. Ekstrom, Schenectady, N. Y.

583,991. Binding Band for Armatures. H. Geisenhoner, Schenectady, N. Y.

583,997. Turntable for Surface-Contact Electric Railways. E. M. Hewlett, Schenectady, N. Y.

584,013. Rail Bond. W. B. Potter, Schenectady, N. Y.

584,029. System of Electrical Distribution. J. L. Woodbridge, Brooklyn, N. Y.

584,056. Igniting Device. B. Jolles, Vienna, Austria-Hungary.

584,062. Synchronizing Mechanism. H. F. Parshall, London, England.

584,149. Automatic Electric Time Switch, L. H. Watters, Media, Pa.

584,155. Electric Regulator. C. C. Gartland, Buffalo, N. Y.

584,173. Hotel Electric Call Apparatus. A. B. Chance, Centralia, Mo.

584,184. Electric Arc Lamp. G. L. Moyer, Hartford, Conn.

584,185. Cutout Switch, G. L. Moyer.

584,186. Electric Arc Lamp. G. L. Moyer.

584,202. Burglar-Alarm System. W. T. Arnold, Chicago, Ill.

584,235. Insulator for Telegraph or Other Electric Wires. C. C. Nesmith and G. F. Arnett, Manchester, Ala.

584,249. Thermostat. H. Van Hoevenbergh, New York, N. Y.

584,258. Prepayment Mechanism for Electrical or Other Meters. C. O. Bastian and H. C. Hodges, London, England.

584,297. Noninterfering Signal Box. J. T. Stack, Chicago, Ill.

584,299. Connection for Electrical Conductors. B. F. Weldon, Pittsburgh, Pa.